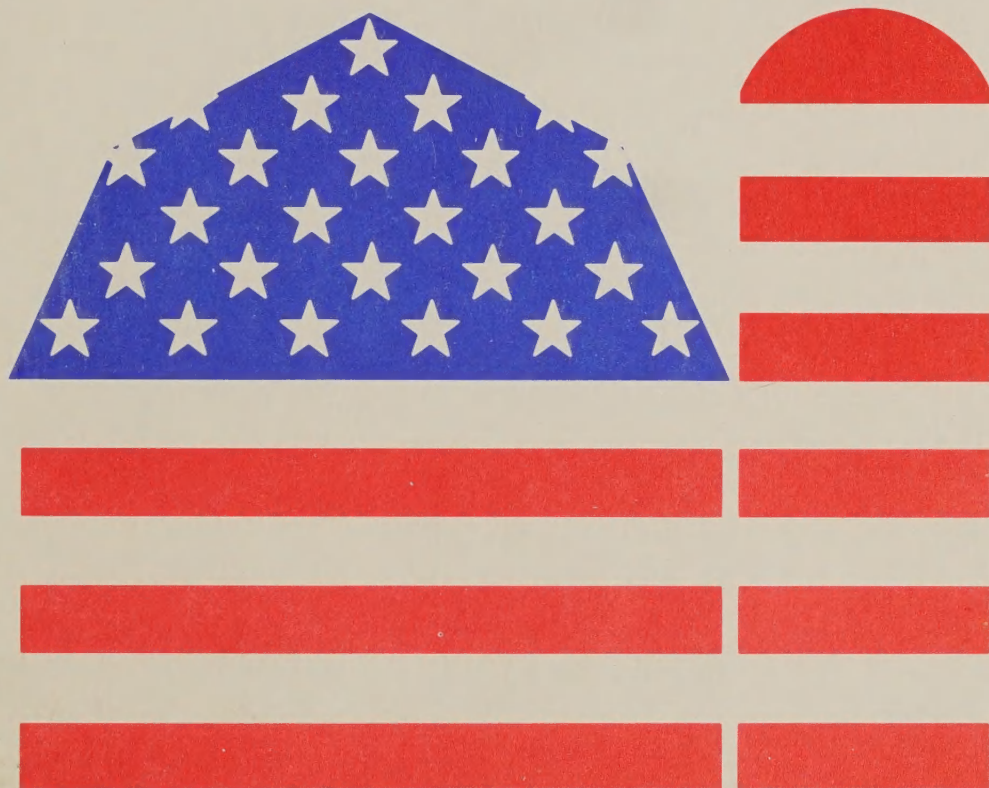


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Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

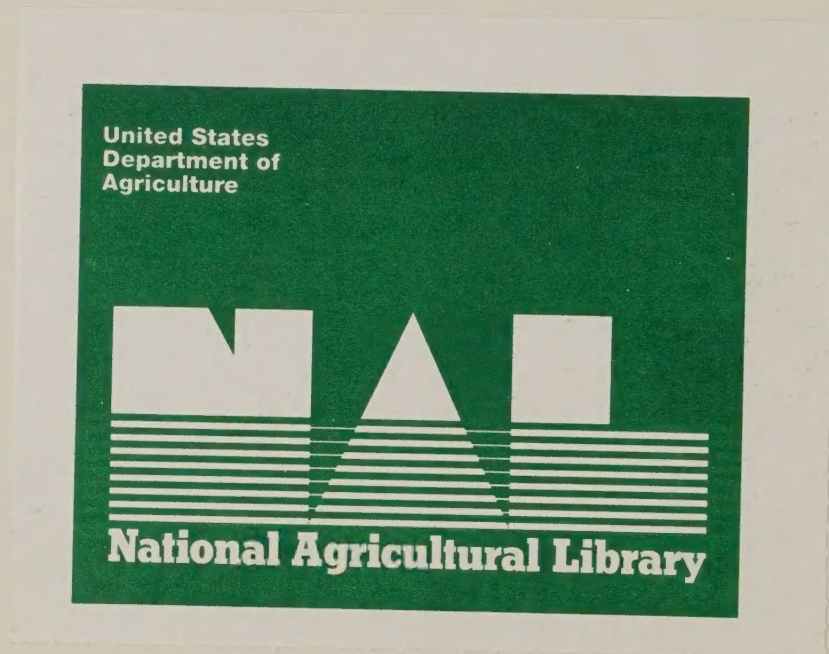


United States Department of Agriculture

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The American agricultural and food system is the nation's largest and most important industry. It accounts for one-fifth of the gross national product and generates 23 million jobs. Agriculture presently contributes about \$19 billion to the U.S. balance of payments and is the largest positive contributor to our merchandise trade balance.

Agriculture has undergone significant changes over the years. Farms are much more specialized, more capital intensive and more reliant on markets abroad than they were just a few years ago. Our food marketing and distribution system has also changed in response to consumer preferences.

American agriculture today is at a crossroads. The time has come when we will decide what role government will take in its assistance to our food and fiber system.

Congress faces the decision about how much assistance farmers should receive and the types of programs under which such assistance will be administered.

To make these decisions under our representative system of government requires informed citizens who will provide leadership for the organizations to which they belong and let their representatives in Congress know what actions they want to see taken to assist our food and fiber system.

This handbook, written by recognized agricultural economists in our state universities and the Department of Agriculture, was designed to increase understanding about our changing food and fiber system. It is through improved understanding that intelligent decisions can be made on the future of this system that serves us all.

John R. Block

JOHN R. BLOCK
Secretary of Agriculture

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I. THE SYSTEM

- **The Farm and Food System:
Major Characteristics and Trends**
- **The Farm Structure of the Future:
Trends and Issues**
- **Food for People and Profit**

Agriculture Policy:

A Citizen's Guide
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The Farm and Food System

Major Characteristics and Trends

Alden C. Manchester

Economic Research Service, U.S. Department of Agriculture

THE FARM AND FOOD SYSTEM is one of the largest sectors in the U.S. economy. Centering on farming, it reaches backward through a chain of farm supply stores, tractor dealers, and fertilizer distributors to farm input manufacturing plants and phosphate mines. Extending forward through the chain are all the activities that move food and fiber from the farm to the dinner table or the clothes closet. On the food side, processing, transportation, and distribution are major parts of the system and all of these activities require inputs from other sectors of the economy ranging from tin cans to paper bags to salt. On the fiber side are all the activities which link the cotton boll or the sheep's fleece to the fabric, clothing, or other material we buy.

The farm and food system is defined and measured in relation to the activities of U.S. farms. But in order to put food on the table and clothes on our backs, the system requires many more nonfarmers than it does farmers. Farmers and their hired workers are only 13 percent of all the people in the food and fiber system, and farming contributes only 11 percent of the value of these products (Table 1).

Many different industries provide inputs both to farming and to the processing and distribution of farm products. Phosphate miners in Florida and elsewhere provide one essential fertilizer ingredient. Other mines provide the ores which become metals that are made into farm machinery, the cans that hold many foods, and many other articles used throughout the farm and food system. The timber industry provides wood which goes into farm buildings, grocery sacks, and cardboard cartons. The government also provides resources such as grazing land, irrigation water, and services such as flood control.

Many firms supply specialized services to farmers. These include pesticide applicators, combine operators who harvest grains for farmers, and many others. Other services supplied to firms at all levels in the farm and food system include financial services from banks and other financial institutions, insurance, and many others.

The manufacturers of all of the inputs to farming,

processing, and distributing agricultural products — ranging from fertilizer and pesticides to salt and tin cans — form a major component of the farm and food system. They contribute 8 percent of the value of farm and food products and employ 7 percent of the workers in the system.

Table 1 — Industries contributing to the farm and food system, 1982.

Industry	Contribution to gross national product		Workers (full-time equivalent)	
	Billion dollars	Percent ¹	Thousand	Percent
Farming	71.1	11.3	3,010	12.5
Inputs to farming, processing, and distribution:				
Mining	7.9	1.3	103	.4
Forestry, fishing, and agricultural services	6.3	1.0	294	1.2
Manufacturing	50.4	8.0	1,555	6.5
Services	113.1	18.1	2,175	9.0
Total inputs	177.7	28.4	4,127	17.1
Manufacturing:				
Food	74.1	11.8	1,786	7.4
Textiles	46.8	7.5	2,791	11.6
Leather	6.6	1.0	861	3.6
Tobacco	8.1	1.3	63	.3
Distribution:				
Transportation	30.1	4.8	804	3.3
Wholesaling and retailing	169.8	27.1	7,314	30.3
Food service	42.6	6.8	3,356	13.9
Total manufac- turing and distribution	378.1	60.3	16,975	70.4
Total farm and food system	626.9	100.0	24,112	100.0

NOTE: The farm and food system as measured here includes manmade fibers, leather substitutes, and fish.

¹ Percent of the total contributions of the farm and food system to the gross national product.

Most, but not all, food is processed. Food processing contributes 12 percent of the total of the system's output and employs 7 percent of the workers. The manufacturing of textile products, leather products, and tobacco products adds another 10 percent to the output of the system and employs 16 percent of the workers. Distribution of farm products contributes 39 percent of the value of these products and accounts for nearly half of the workers.

The Food and Fiber System: A Century of Transition

Alden Manchester and Kathryn L. Lipton
Economic Research Service
U.S. Department of Agriculture

Today's U.S. food and fiber system barely resembles what existed at the turn of the century or even just prior to World War II. The number of farms has declined from a peak of 6.5 million in the mid-1930's to 2.3 million, while average size has increased from 155 acres in 1935 to about 437 acres. Machines have replaced animal power and such scientific techniques as tissue culture and gene splicing have increased yields and improved plant and animal characteristics. These and other changes have enabled U.S. agriculture to meet domestic food needs at reasonable prices while becoming the world's leading exporter.

Changes in farming paralleled those in the structure of agricultural markets. Food manufacturing companies declined from 68,000 in 1919 to 36,000 in 1947 and about 19,000 today, a trend associated with the growth of large corporations and the disappearance of thousands of local milk dealers and bakeries.

Today, U.S. consumers spend a smaller fraction of income on food than any other nation. With incomes rising faster than expenditures, the percent used for food purchases is less than half the share at the turn of the century (figure 1).

Advances Occur in Agriculture

Until early in the last century, the U.S. economy was mainly agricultural. In 1810, 84 percent of the labor force was in farming, and these workers produced 72 percent of the gross national product (figure 2).

The 19th century brought industrialization. Dependence on man, animals, and water for power declined as technological developments in machinery were adopted. The shift to coal, petroleum, and later, electricity and gas, brought extensive changes in production and transportation. In 1860, animals accounted for

Figure 1. Consumer Expenditures

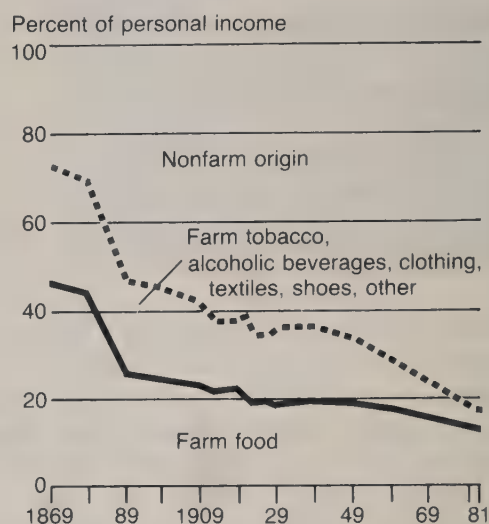
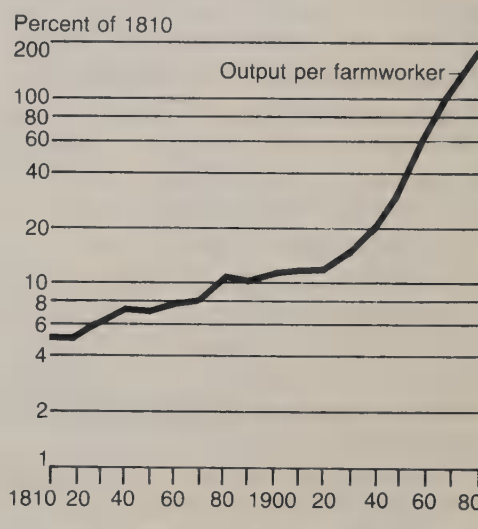
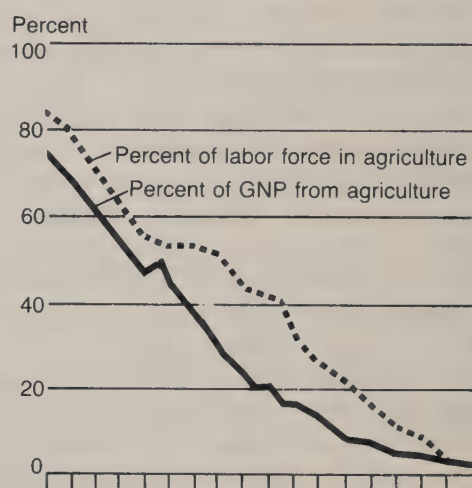


Figure 2. The Industrialization of Farming



*The authors are senior economist and staff economist, respectively, in the Office of the Director, National Economic Division.

79 percent of all power in the economy; humans, 15 percent; and water and mineral fuels, 6 percent. By 1940, 90 percent of all power came from mineral fuels and water, 6 percent from animals, and 4 percent from man. Today, animals are rarely used for agricultural production or transportation and manpower is down.

The mix of inputs used to produce crops and livestock has changes over the years. In 1950, labor accounted for almost 40 percent of the value of all resources used in farming; by 1977, it had declined to 14 percent. In contrast, machinery and chemicals rose from 25 to 43 percent. Fertilizer use has increased more than five-fold since 1950. Although the number of tractors rose only 30 percent, the average horsepower increased almost 150 percent.

Today, many of the inputs farmers use are purchased rather than produced on the farm. Between 1910-14 and 1980, total inputs used in farming increased 19 percent; however, those purchased rose 224 percent, while non-purchased ones, including operator and family labor, decreased 48 percent.

Extensive use of purchased inputs has increased a farmer's vulnerability to rising costs and interruptions of supplies. Prime examples include the rapid oil price increases and supply shortages of 1974 and 1979, and the recent growth in real interest rates (interest rates minus inflation). Between 1972 and 1983, input costs increased an average of 151 percent, while prices received by farmers rose an average of 94 percent, causing a cost-price squeeze.

Purchasing land, equipment, and other inputs has increased the need for borrowed capital. It totaled 21.6 percent of assets in January 1984—twice as large as it was in 1945 and 1950. Interest payments were 14.7 percent of gross farm income in 1983, compared with an average of 7.2 percent between 1910 and 1934, and 4.0 percent in 1940.

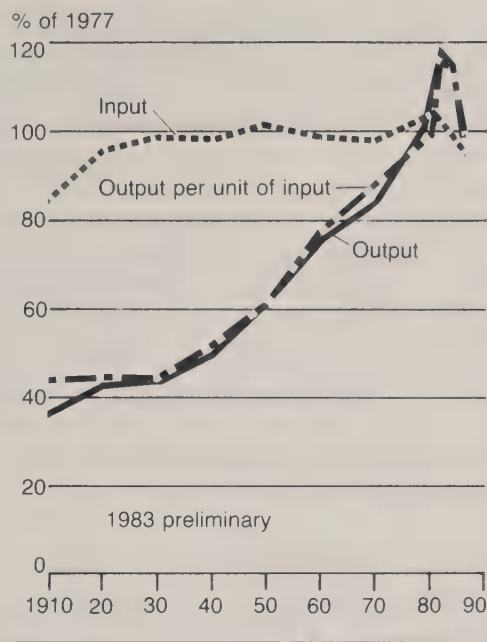
Greater Efficiency in Agriculture

Changes in agriculture boosted productivity. Output per unit rose 226 percent between 1870 and 1982, much of it during the past 30 years (figure 3).

Output per farm worker doubled between 1810 and 1880 and again by the early years of World War II. Since 1950, it has risen nearly six-fold. These increases resulted from many factors, including the expansion of the nation's agriculture to the more productive lands of the Midwest, shifts among crops, and improvements in farm management, pest control, and cropping techniques.

Applied genetics alone have probably accounted for as much as 50 percent of harvest increases since the 1930's. Average yields per acre of corn, sorghum, and tomatoes for processing, for example, have increased over 450 percent. Yields of other crops rose between 65 and 352 percent.

Figure 3. Farm Productivity



Rising output per farm worker increased total production to meet the needs of a rapidly growing population while using a declining share of the total work force: 84 percent in 1810; 50 percent in the early 1880's; 40 percent in 1900; and only about 3 percent today.

The Trend Toward Specialization

A century ago, farms were self-sufficient units producing a mix of crops and livestock. This helped assure employment of family through the year and provided food for the home. In 1869, 23 percent of the food grown on the average farm was consumed there. The share of home consumption declined irregularly and fairly slowly until after World War II, when it dropped sharply to less than 1 percent.

Technological and scientific breakthroughs have generally encouraged specialization as farmers rely on chemical fertilizers, insecticides, and herbicides to increase soil fertility and control pests. As a result, a farmer can grow the crops with the most potential for profit year after year.

Similarly, scientific advancements have given meat and poultry producers unprecedented opportunities to specialize. In the poultry industry, for example, improvements in breeding, nutrition, housing, equipment, rearing, disease control, and management have boosted productivity and enabled fewer but larger producers to meet the growing demand for their products.

Improvements in farm machinery have helped foster large, specialized operations. Efficient and economical use of equipment usually requires larger acreage, often

planted in just a single crop. As farm size increases, growers can make effective use of more and better equipment, thereby reducing the average cost per acre of producing their crop. A 1972 study revealed that between 1930 and 1970, the acreage needed to reach the lowest average cost increased 500 percent for wheat farms. Similar changes have occurred in livestock and poultry operations.

The increase in size and specialization has not meant that nonfarm firms are taking over the ownership and operation of American farms. In 1974, 3.4 percent of agricultural products sold came from farms owned by business-associated corporate firms. These farms were important only in specialized crops, such as sugarcane and seed and, to some extent, poultry and beef feedlots. The share sold by these business-associated corporate farms has declined since 1974.

Changes in Processing and Distribution

Through the mid-19th century, food and textile businesses were small. Most performed a single economic function, producing a line of products, or trading at one level of the marketing system, often from a single location.

The structure of modern business firms began to emerge in the last quarter of the 19th century as operations of several previously separate units were combined under a centralized management to improve profits. The first big food manufacturing firms were in meat packing, sugar refining, and oils. Only cigarette manufacturing started with a few relatively large firms which expanded rapidly.

More recently, leading food manufacturers have diversified. A 1983 ERS study reveals that in 1919, a sample of 37 large food firms participated in 125 industries, an average of three each. By 1977, an average food manufacturing firm among the 100 largest produced in 12 different manufacturing industries, more than double the number only 23 years before. Diversified firms may encompass industries both within and outside the food and fiber system.

Large corporations characterize agricultural processing and distribution. In 1977, the 100 largest food processing companies accounted for 53 percent of the value added to farm products in the form of processing, packaging, and other manufacturing services. Another 100 companies accounted for an additional 11 percent. These 200 companies are broadly diversified. Sales of processed foods, alcoholic beverages, and tobacco make up about half of their business. Nonfood firms have been diversifying into food and beverages, with their share rising from 1 to 12 percent of output over 25 years.

Independent wholesalers, the traditional bridge between processors and retailers, have lost substantial influence in the marketplace with the vertical integration

of chain stores. As chain stores' share of total grocery sales grew from 34 percent in 1948 to 59 percent in 1977 (table 2), they began distributing or wholesaling dry groceries and some perishable products.

Only smaller chains and independent grocery stores continue to rely on about 675 large general-line wholesalers for their supplies. In addition to providing a wide array of food and nonfood products, these wholesalers furnish numerous managerial, recordkeeping, and financial services to the supermarkets.

Demand for Foods Also Changes

Despite such technological advances as frozen and dehydrated foods, the proportion of processed products consumers purchase has changed little over the years. About 87 percent of foods consumed in 1869 were manufactured, 83 percent in 1909, and 90 percent in 1980.

What is substantially different is the mix of products we eat. In 1869, flour and cornmeal accounted for 52 percent of processed food products, and cured meats, dairy products, and sugar, 37 percent. By 1978, flour and other grain products accounted for only 3 percent, and bakery products, 9 percent. Meat and poultry represented 29 percent, processed fruits and vegetables, 15 percent, and soft drinks, 8 percent.

Per capita consumption of foods other than beverages (coffee, tea, and soft drinks) is only slightly more than in 1910 (table 3). But consumption of certain products has changed substantially—grain products have dropped by more than half; fats and oils more than doubled; sweeteners and meat, poultry, and fish are up sharply; and dairy products and eggs rose and then fell. Beverage consumption is up more than 90 percent from 1910.

Two-thirds of food for use at home now comes from the supermarket—up sharply from 37 percent in 1958 (table 4). Convenience stores account for 4 percent and other grocery stores, 12 percent.

Table 2 — Chain Store Shares of Sales Have Increased.

<i>Type of chain</i>	<i>1948</i>	<i>1958</i>	<i>1967</i>	<i>1977</i>
<i>-----Percent-----</i>				
Supermarket chains with distribution centers:				
National	18.6	19.7	16.2	14.7
Regional	3.9	8.2	8.5	9.9
Sectional	3.1	4.3	6.6	10.9
Local	—	—	1.6	1.3
Owned by grocery wholesalers	4.5	9.0	13.4	10.1
Total	30.1	41.2	46.3	46.9
Other chains	4.3	2.8	5.1	12.0
All chains	34.4	44.0	51.4	58.9

— = Not available.

Table 3 — The Mix of Foods Consumers Eat Has Changed¹

<i>Product</i>	<i>1910</i>	<i>1959</i>	<i>1980</i>
Meat, poultry, fish	137	145	179
Dairy products	325	455	344
Fruits and vegetables	466	426	446
Eggs	34	44	31
Grain products	297	166	151
Sweeteners	89	117	126
Fats and oils	24	39	53
Nuts, cocoa, herbs and spices	5	12	14
Subtotal	1,377	1,404	1,344

Beverages (coffee, tea, and soft drinks)	1,653	1,857	1,880
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¹Edible weight, pounds per capita, resident population (civilian and military).

Table 4 — Supermarkets' Share of Sales of Food for Home Use Grows

<i>Type of seller</i>	<i>1939</i>	<i>1958</i>	<i>1982</i>
-----Percent-----			
Supermarkets	5.8	36.5	67.4
Convenience stores	0	.1	4.4
Other grocery stores	52.4	37.0	12.0
Other food stores	14.1	11.2	7.9
Other stores	7.7	4.7	5.8
Home delivered	14.9	7.3	.6
Farmers, processors, wholesalers, other	5.1	3.2	1.9

The away-from-home market is expanding rapidly, primarily because of the growth in sales of fast food establishments, which now account for 41 percent of eating-out dollars, compared with 25 percent in 1958. Sales of conventional restaurants, lunchrooms, and cafeterias are down from 54 percent in 1958 to 40 percent now (table 5).

The United States in World Markets

Foreign demand for U.S. crops rose sharply after 1973, greatly increasing the role of agricultural exports in the U.S. economy and the stake of the crop farmer in other markets (figure 4). Rapid growth in food imports by the less-developed nations and the centrally planned countries of Eastern Europe and the USSR expanded U.S. markets for grains.

The United States is the leading exporter of agricultural products and accounts for nearly half of world grain trade, compared with 31 percent in 1951-55. More than half of U.S. production of wheat, rice, and cotton was exported in 1983 and nearly half of the soybeans and corn. Only about 4 percent of livestock products are exported.

Table 5 — Shares of Away-from-Home Food Market Sales

<i>Type of seller</i>	<i>1939</i>	<i>1958</i>	<i>1982</i>
-----Percent-----			
Restaurants, lunchrooms, cafeterias	46.6	53.5	40.1
Fast food places	7.1	5.4	30.1
Hotels and motels	10.8	6.1	5.8
Schools and Colleges	6.8	12.0	10.0
Stores, bars, direct selling	21.1	14.7	8.1
Recreational places	1.9	2.4	2.4
Others	5.7	5.9	3.5

Exports have always been important to U.S. farmers. In 1850, 90 percent of all cotton was exported; half of the annual crop was exported until the Depression. The share declined to a record low of about 20 percent in the early 1960's, as synthetics replaced cotton worldwide and cotton production in other countries came closer to matching their demand.

In the twenties and thirties, more than half of all exports were raw materials, such as cotton, tobacco, hides, and tallow. Since 1950, the big increase has been in feed products, largely corn and soybean meal.

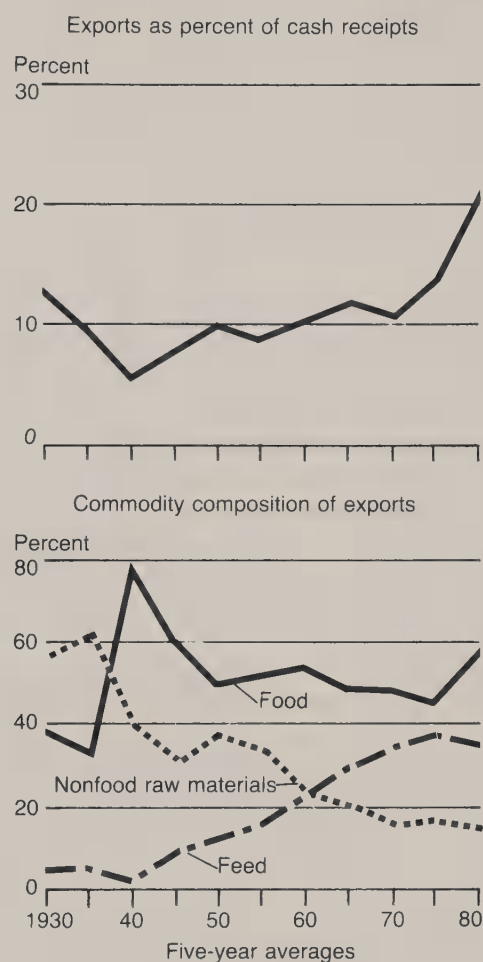
Agriculture's contribution to the U.S. balance of trade increased substantially during the 1970's. Net exports of U.S. farm products (exports minus imports) rose from about \$1 billion in 1969 to a record of nearly \$27 billion in 1981. During 1983, agricultural exports of \$36 billion partly offset an \$80-billion deficit in non-farm trade, reducing the total U.S. balance of trade deficit to approximately \$61 billion. In the early 1950's, agricultural trade was in a deficit position and nonagricultural trade was in surplus. In those years, nonagricultural items posted a \$4 billion positive trade balance, while agriculture was running a deficit of about \$1 billion.

Government's Changing Role

Government involvement in the food and fiber system dates back to colonial times. There was detailed regulation of farmers' markets in colonial towns, the establishment of legal tender, and a system of legal rights and obligations which applied to agriculture as well as other forms of trade.

With the opening of the West, the Federal Government gradually moved to a system of subsidizing agriculture through the availability of cheap, and eventually, nearly free, land. Agricultural research got its first big boost through the establishment of the Department of Agriculture in 1862 and substantial Federal assistance to State Agricultural Experiment Stations. By World War I, extension was a going activity, as were market news, grading services, and the crop and livestock reporting program.

Figure 4. Agricultural Exports



The agricultural depression of the 1920's brought the first efforts to assist farmers with their income problems. The general depression of the 1930's brought much more effort to assist farmers through price-support programs, credit, conservation, rural electrification, and other aids. Those programs are still in place today, though they change as circumstances inside and outside agriculture create the need.

Government also plays a bigger role in supporting food consumption today. Through food stamps, contributions to school lunches, feeding the military, and other programs, Federal and State governments paid for 6 percent of all food in 1983, up from 2 percent 25 years earlier. This increase reflects the expansion in the Federal feeding programs starting in the early 1970's.

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The Farm Structure of the Future: Trends and Issues

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AERICAN AGRICULTURE is a diverse industry which is constantly responding to economic conditions and new technologies. Farmers are now increasing their production with a changing mix of resources—land, capital, labor, and management. Simultaneously, other characteristics in the structure of U.S. agriculture are also changing. These changes in how the farm system is organized and in related distributions of income and wealth are of concern to farmers, rural people, consumers, and agricultural policymakers.

The structure of agriculture refers to how farm resources are organized and controlled. Structure includes the number and size of farms, the ownership and control of farmland and of capital and labor, the arrangements for input and producer marketing, and other factors which affect decision making and the control of resources.

Traditionally American agriculture was dominated by “family farms” on which farm operators and their families provided most of the labor, made the management decisions, owned part of the resources, accepted most of the production and price risks, bought and sold in the open market, and depended on the farm as their major source of family income. Family farms have been revered since the days when Thomas Jefferson argued for national policies of public land distribution that favored small, independent landholders. In recent years, the dispersed, independent farmer, open market system of farming has become less dominant in the American agricultural industry. A major question being asked today is whether this family farm system should continue and whether society should take steps to halt present trends which are gradually diminishing its prominence.

Providing enough food for U.S. consumers is not a current concern. The U.S. comprises only 5 percent of the world's population but it produces about 20 percent of the world's grain. Even while exporting one-fourth of their total production, U.S. farmers produce enough food to keep U.S. consumers among the best fed in the world.

Although U.S. agriculture is highly productive, various public interest groups are concerned about the

changes in the structure of agriculture and the possible effects of these changes on the future agricultural industry and on related public economic and social goals. Members of these groups have expressed concerns about whether our future agricultural industry will use resources productively and efficiently, whether it will produce what consumers want at reasonable prices, and whether it will be resilient in the face of economic stress and change.

Changes in the structure of agriculture raise questions about the distribution of wealth and income among farm operators, farm workers, and others who own and supply farm resources as well as about whether new farmers can get a start in farming by any means other than inheritance. Rural people are concerned about the effect these changes will have on the economic and social viability of rural communities. Another issue involves the question of how federal, state, and local government policies and regulations affect farm resource organizing and managing decisions, and how these, in turn, affect demands for governmental assistance. Many people are concerned about whether the family farm system will survive and whether it will retain its characteristics of independent farm operators, opportunities for new farmers, dispersed land ownerships, and open markets.

Recent Evolution in Farm Structure

The traditional family farm is losing its dominant place in rural America as agriculture continues to move toward larger but fewer farms, more part-time farmers, changes in ownership patterns, specialization in particular crop and livestock enterprises, and big industry production of some commodities. This evolution results from the interaction of several factors including mechanization, new techniques in plant and animal production, the economic advantages of larger sized farms, market forces, the large capital investments required for farming, and public policies affecting agriculture. It also results from international demands for U.S. farm products and general economic conditions in the U.S. farm economy.

David Harrington, Economic Research Service—USDA, and Vernon Sorenson, Michigan State University, contributed reviews of the paper. This is one of a larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

Numbers and Sizes of Farms¹

A very obvious change in agriculture is the trend toward larger but fewer farms. The number of farms in the U.S. reached a peak of about 6.8 million farms in 1935 and this number has now dropped to approximately 2.4 million. The rate of decline has slowed since the late 1960's with practically no change between 1974 and 1978 agricultural census periods. Researchers estimate that the total number of farms has not changed significantly since 1978 but that the changes in size distribution have continued.

The total amount of land in farms, about 1.0 billion acres, has declined only slightly since the 1930's, which means that average farm size has increased inversely to the decline in farm numbers. However, the present average sized farm for the U.S., just over 400 acres, has little meaning because of the way in which farm size is distributed. Forty percent of U.S. farms have less than 50 acres. Seven percent range from 1,000 acres to many thousands.

The difference in size distribution is even greater when measured by share of production or sales per farm as shown in Table 1. Small farms with annual sales of less than \$10,000 comprise nearly half of total farms but account for less than 4 percent of total farm cash receipts. On the large end of the size spectrum, those farms with annual sales over \$200,000 comprise just over 4 percent of the farms but account for nearly half of total farm cash receipts.

Because of the large number of small farms, the decline in farm numbers is concentrated among smaller farms. However, the rate of decline is greater among the intermediate-sized farms. Furthermore, the increase in the number of larger farms contrasts sharply with the decline in number of intermediate-sized and smaller farms. The current trend in farm size distribution is toward some decline in total number but the continua-

tion of many smaller farms, a sharper decline in number of intermediate-sized farms, and a continued increase in the number of large farms.

These statistics reflect a combination of developments. Farmers operating the intermediate-sized units frequently find that farm income is inadequate with the result that they are under pressure to acquire more farm resources, to adjust farm activities in order to combine farming with nonfarm employment, or to leave farming altogether.

In 1983, over 60 percent of all farm units had less than \$20,000 in farm product receipts, as shown in Table 1. Household members on most, but not all, of these farms have off-farm jobs and income as well. They are often referred to as part-time farmers. As shown in the table, these smaller farmers as a group showed a small loss in net farm income but averaged \$18,000 to \$21,000 in off-farm income. However, a significant number of these smaller farmers have very limited income even when both farm and off-farm income are considered.

Types of Farms and Size

The number of family farms is declining in comparison to other kinds of farms but they still account for a major share of total farm production. If small farms are included, family farms comprise about 90 percent of all farms and account for about 60 percent of total farm product sales.

"Larger than family farms" are organized like the family farms but they hire more labor. By one USDA definition, larger than family farms are those that require more than 1.5 man-years of hired labor. These farms constitute 5 to 8 percent of farms and account for 20 to 25 percent of total farm product sales.

"Industrial farms" are organized more like big business, separating ownership, management, and labor. These are usually specialized farms producing

Table 1—Distribution of Farms, Total Cash Receipts, and Farm and Off-Farm Income Per Farm by Sales Class, 1983.

<i>Sales Class</i> <i>Value of Farm</i> <i>Products Sold</i>	<i>Number</i> <i>of Farms</i> <i>(000)</i>	<i>Percent of</i> <i>All Farms</i>	<i>Percent of</i> <i>Total Cash</i> <i>Receipts</i>	<i>Average</i> <i>Net Farm</i> <i>Income</i>	<i>Average</i> <i>Off-Farm</i> <i>Income</i>	<i>Average</i> <i>Total</i> <i>Income</i>
Less than \$5,000	829	35.0	1.6	\$ -493	\$21,106	\$ 20,613
\$5,000-\$9,999	325	13.7	2.0	-155	20,047	19,892
\$10,000-\$19,999	279	11.8	3.2	263	18,061	18,324
\$20,000-\$39,999	272	11.4	6.4	2,945	13,547	16,492
\$40,000-\$99,999	381	16.1	20.0	10,654	11,253	21,907
\$100,000-\$199,999	177	7.5	19.3	26,681	11,793	38,474
\$200,000-\$499,999	83	3.5	18.5	62,233	14,610	76,843
\$500,000 & over	24	1.0	28.9	567,585	28,603	596,188
All Farms	2,370	100.0	100.0	\$ 11,749	17,299	\$29,048

Source: *Economic Indicators of the Farm Sector: Income and Balance Sheet Statistics, 1983*, ECIFS 3-3. USDA Economic Research Service, 1984.

¹ The census definition of a farm has changed a number of times since 1850. Since 1975 the census definition of a farm has been "any place from which \$1,000 or more of agricultural products were sold or normally would have been sold during the census year."

commodities such as broilers, eggs, sugarcane, fruits, vegetables, and fed cattle. They comprise less than 2 percent of farms but they account for 15 to 20 percent of total farm product sales.

Incorporation as a form of farm business organization has been increasing. By 1978 there were about 50,000 incorporated farms. Nearly 90 percent were family held corporations formed for management and tax purposes. In operation these corporations are similar to ordinary large family farms.

Land Tenure

The ownership and control of land are important structural features of agriculture. There are 6.2 million owners of farmland in the U.S., including individuals, partnerships, and corporations. Nationally 5 percent of these owners own 53 percent of the farm and ranchland. This concentration of ownership varies by regions. In the Northwest 5 percent of the owners own about 70 percent of the land. In the Corn Belt 5 percent of the owners own 27 percent of the land. Other regions vary between these extremes.

Nationally, farm operators own about 60 percent of the farmland; they rent 40 percent from other owners. These proportions have not changed significantly during the last 30 years. The significant change in tenure among farm operators has been the shift toward part owners—that is, farm operators who own part of their land and expand their operations by renting additional land. In 1950 part owners comprised 15 percent of farmers and operated about 40 percent of the land. In 1978 they constituted 29 percent of farmers and operated 57 percent of the land.

Full owners have remained fairly constant at about 58 percent of farmers, but the percentage of full tenants has declined. In 1950 full tenants comprised 28 percent of farm operators and farmed 18 percent of the land. In 1978 they accounted for only 13 percent of farm operators and farmed 12 percent of the land.

Dynamic Aspects of Change in Farm Structure

Changes in the structure of U.S. agriculture have occurred rapidly since the early 1940's, and these changes have become even more obvious in the last 20 years. Several factors have contributed to the continuing changes in farm structure. These include new technology involving high capital costs, high capital requirements for farming, reduced needs for farm labor, off-farm job opportunities, and various public policies.

The Role of Technology

Technology has enabled farmers to change the mixes of resources they use and to greatly increase productivity using the same amount of land but less labor. Since 1940 the number of average annual farm workers has

dropped from over 10 million to under 4 million. During this same time total farm production has nearly doubled.

Technology is labor saving, land saving, and capital using. Farm mechanization has been primarily labor saving and has led to one man being able to handle more land or more livestock. At the same time land saving technology, primarily biological and chemical, has increased crop and livestock production from land resources. Together labor saving and land saving technology have greatly increased farm output per person. Since 1945, the average acreage per farm has more than doubled and the production per man-hour has increased sevenfold, but the capital requirements per unit of production have increased correspondingly.

Technology and the capital investments which are required of a farmer using it encourage farmers to specialize in crop and livestock production. Pesticides and fertilizers reduce the need for crop rotation and diversification. Technology in livestock feeding and disease control permit poultry and livestock producers to specialize in very large operations.

Adopting mechanization and production technology permits farmers to expand their farm operations and to reduce their per unit costs of production. For example, a corn farmer invests in modern tillage, planting, and harvesting equipment and uses high yielding seed varieties, optimum fertilizer levels, and chemical weed control. With this combination of resources the farmer can handle many more acres per person and get a greater yield per acre so that total costs per bushel may be reduced. These economies of size have been a major force in creating larger farms. However, many farms have expanded beyond the point where least cost is first reached. Expansion beyond this point results from a farmer's desire to increase income.

Some technologies have been adapted to facilitate small scale farming as well. Part-time farmers holding off-farm jobs find it possible to operate their farms by working in the evenings and on weekends. Mechanization, chemical fertilizers, pesticides, and drugs for control of livestock diseases all enable them to do this.

Labor Requirements and Mobility

As mechanization has replaced the need for labor on farms, job opportunities in the nonfarm economy have also contributed to the transformation of U.S. agriculture. Many people have decided that nonfarm opportunities are more attractive than their prospects in agriculture. By 1977 the U.S. farm population was less than 8 million, compared with a high of over 32 million in the post World War I period and again at the height of the depression of the 1930's. If nonfarm job opportunities had been fewer, more people would have stayed on farms. Nevertheless, farm numbers could have adjusted more rapidly. Due to their age or abilities, many farmers did not have skills for nonfarm employment,

and many farm families prefer rural life even if it means lower incomes. Thus farm numbers did not decline fast enough to permit average farm family income to keep up with average nonfarm family income.

Capital Needs and Financing

Sharply rising land values, inflation, and the costs of adopting new technologies have greatly increased the capital requirements of those farmers expanding their operations. The availability of short-term and long-term credit has made it easier for farmers to consolidate their resources into larger units and to use newer technologies which require increased capital.

Historically farmers' land values have been high in comparison to their current earnings because land buyers capitalized expected future earnings from farm expansion, appreciation of land values, and improved yields due to technology into the prices they were willing to pay. This meant that current incomes on newly purchased parcels of land were not sufficient to meet cash flow requirements. The land price boom of the 1970's further exaggerated this cash flow problem. More recently farm earnings have been down and land values have declined somewhat.

Those most able to buy land are well established farmers with equity or off-farm investors with income from other sources. Credit institutions are willing to finance the expansion of established farms but they may not be willing to finance beginning farmers or small farmers trying to buy more land, who depend on current farm income to make payments on loans.

Similar financial restrictions, but less severe ones, apply to beginning farmers and small farmers attempting to rent land or to invest in livestock enterprises or other specialized production. The large amounts of capital required and the high interest payments give the competitive advantage to the established farmer who is expanding an operation rather than to the beginning or smaller farmer.

During periods of inflation farmers with limited resources are at a disadvantage in obtaining credit. They have difficulty demonstrating that they can meet mortgage payments entailing interest rates which are often greater than current returns to their farm assets. Accordingly, the economic position of wealthier, higher income people is strengthened during such periods.

Evaluating Change in Farm Structure

An evaluation of the changing structure of agriculture includes public concern not only about farmers and their families but also about the productivity of agriculture, land ownership, the status of farm workers, and the effects of change on rural communities.

Efficiency and Productivity in Agriculture

The efficient use of agricultural resources helps consumers by providing them with an adequate supply of

food and fiber at relatively low cost and helps farmers by allowing them to remain competitive in domestic and export markets. Historically the intermediate-sized family farm which has dominated agriculture has been efficient in production, responsive to changes in market demands, and resilient under economic stress. Analysis of the current trends in the changing structure of agriculture indicates that the most efficient farm size and organization varies with different types of commodities.

In general crop production sectors, intermediate-sized farms seem to achieve most of the efficiencies of production. The most efficient size does not remain static but increases over time with the use of technology. Research indicates that minimum costs per unit of output are achieved by intermediate-sized family farms but that these costs do not increase as farms get larger. That is, there are no significant diseconomies of size. This implies that from the standpoint of producing food efficiently, intermediate-sized family farms are as efficient as large farms. However, farms continue to enlarge because net income increases with size. Large farms have a competitive advantage in purchasing inputs at lower costs and in accumulating capital to use in acquiring new technologies and expanding the business. Also, income tax rules encourage continual expansion as a way to reduce tax liabilities.

Current research evidence suggests that there are efficiency advantages of size in certain types of livestock production and in some specialized fruit and vegetable enterprises. Large-scale and integrated operations in poultry production and beef feeding account for major shares of national production. Family farm size operations still dominate hog production and dairy farms, but large-scale operations are increasing in some regions—for example, the large drylot dairy farms in the Southwest. Large-scale producers of certain fruits and vegetables appear to have economic advantages over small producers.

Family farms have proven themselves resilient and able to maintain production under economic stress caused by weather or depressed income. Large farms may be somewhat less adaptable under some economic stress conditions. Regardless of farm size, the ability to make annual debt payments is a primary determinant of a farmer's ability to withstand adversity. Both family farms and large farms appear to be efficient in use of resources and in producing adequate supplies of food and fiber.

Land Ownership and Entry by Young Farmers

Land ownership and control significantly affect the distribution of farm wealth and income. Widespread, unrestricted ownership of land and ownership by farm operators has been the American tradition and this tradition has helped to shape the structure of agriculture. Although U.S. farmland is distributed among nearly 7 million owners, much of it is concentrated in

the hands of larger landholders. Traditional patterns of land ownership and control are changing. Concentration of ownership is shifting to larger farms and to some extent to wealthy nonfarm investors. Part-owners of larger farms manage an increasing share of the land through a combination of ownership and rental. An increasing share of land is owned and controlled by partnerships, family-held corporations, and other corporations instead of by the traditional individual landholder. How fast these changes are taking place is difficult to measure but they are gradual. Less than 3 percent of farmland changes hands annually.

If the family farm structure is to be a major part of the future U.S. agricultural industry, there must be opportunities for new entrants and for small and intermediate-sized farmers to gain additional land resources. Inflated land values and high capital requirements for farming make getting started extremely difficult unless beginning farmers can participate in ongoing family farm businesses. Economic incentives and tax provisions encourage landowners to hold onto land rather than sell it to potential farmers. Present trends indicate that more and more land will be owned by hereditary landholding families or, as some would say, by a "landed aristocracy."

Land ownership and the structure of agriculture are closely related. If the public accepts present land ownership trends, no major policy changes are needed. However, if the public sees a need to alter present trends by slowing or reducing the concentration of ownership, new planning will probably involve changes in a range of policies that affect the returns from ownership of land rather than changes merely in specific policies on who can own land and how much they can own.

Types of policies that could influence land ownership include: credit programs aimed at assisting beginning farmers, new rental/purchase arrangements for beginning farmers with public assistance, adjusting income tax and estate tax provisions that now favor large and expanding farmers, preferential property tax laws on land use and ownership which favor beginning and family farmers, placing limits on corporate farm operations, and other policies aimed at achieving public goals for land ownership.

Farm Labor Needs

Farm family workers have been the major farm labor resource throughout much of U.S. agricultural history. The hired labor market has affected farm structure only marginally. Rather, farm mechanization and the changing farm structure have tended to shape farm labor markets.

Total farm employment continues to decline but in recent years the number of hired workers has slowly increased. The annual average number of hired farm workers declined from a peak of 3.4 million in 1920 to

1.2 million in the early 1970's. The number has now leveled off at about 1.3 million, which is about one-third of total farm employment. About 3 million different workers are employed on farms, but about 60 percent are short term seasonal workers and 25 percent are longer term seasonal workers. Only 15 percent are employed full time in agriculture. Seasonal labor dominates in the specialized fruit and vegetable production areas.

Farm labor policies have been aimed at improving the lot of hired workers. Federal and state protective legislation has gradually been extended to farm workers, beginning with Social Security and now including minimum wage legislation, worker's compensation, unemployment insurance, and health and safety regulations. However, much of this legislation covers only farms with above a minimum number of workers so it does not apply to the typical family farm.

Future public policies on farm labor need to be aimed at two general objectives: (1) continuing to improve the economic opportunities and position of farm workers, (2) helping to provide the agricultural industry with a supply of workers so that large farms and family farms can meet their labor needs at competitive labor costs. At times these two objectives may be in competition with each other.

Implications for Rural Communities

The changing farm structure will continue to affect economic and social conditions in rural areas but not to the extent that it has in the past. Following years of farm population outmigration and the growth of non-farm economic activities in rural areas, farming no longer dominates rural America in many sections of our country. Farm people make up only 15 percent of the national rural population.

The relative importance of agriculture in rural communities varies widely in different areas of the country. In parts of the Corn Belt and the Great Plains, rural communities depend heavily on the farm economy. Over 600 of the approximately 3,000 counties in the U.S. are basically agricultural counties. In these counties, continued enlargement of farms and specialization in agricultural production will hurt smaller rural communities. Although the markets for specialized farm supplies and services will expand, they will tend to be centered in larger towns. In smaller communities there will be less support for private business and less support for local governments, schools, churches, and other community institutions.

If future policies are to help maintain viable rural communities in areas dominated by farming, these policies must help maintain the family farm system, encourage economic development and nonfarm job opportunities in these rural areas, and help part-time farmers to improve their nonfarm incomes.

Policies That Affect Farm Structure

Federal policies have influenced the structure of agriculture in several ways. Although most public policies aimed at agriculture were initiated and designed to help family farms, their net effects have often encouraged the enlargement of farms. If present trends in the changing structure of agriculture do not coincide with public goals, the elected representatives of the public can develop policies to alter the direction of agricultural change.

Credit Policy

A viable changing agricultural system needs capital which can be generated from internal savings or borrowed from outside the system. Starting with the enactment of the Federal Land Bank Act in 1916, agricultural policymakers have attempted to provide farmers with a plentiful supply of capital at reasonable rates. Credit policies have given farmers access to capital through the Farm Credit System, the Commodity Credit Corporation, the Farmers Home Administration, and the Small Business Administration.

Abundant supplies of relatively low cost capital have helped build a modern, high technology, productive agriculture. Easy access to capital may have encouraged overinvestment in farm production assets and contributed to inflated land prices. These changes coincide with the enlargement of farms. It would appear that public credit policies which supply low cost capital have contributed to present trends in the changing structure of agriculture.

Credit policies do influence farm structure. To what extent should the Farmers Home Administration or other special programs be aimed primarily at beginning farmers, low resource farmers, and small family farms? These farmers need assistance if they are to compete with larger, established farms in gaining access to land and capital resources.

Farm Income-Support Programs

Various farm income-support programs have been part of federal agricultural policy since the 1930's. These programs for grains, cotton, dairy products, and other selected commodities have generally included provisions to improve farm income through price supports, adjustment of national production through idled crop acres, commodity storage, and market expansion. Price and income-support programs have been based primarily on volume of production per farm, which means that large farms received more income benefits than small farms. However, research indicates that this type of income benefit by itself resembles a general price increase and apparently offers no significant incentives to enlarge farms.

The indirect benefits of commodity price and income-supports are the reduction of risk and uncertainty, and

these benefits appear to affect farm structure. With reduced risk, farm operators are encouraged to borrow money to invest in additional land and technology and specialized production. Guaranteed returns, particularly, encourage long-term investments such as land purchases or the construction of modern livestock facilities. With these program benefits the larger, well established farms can expand further with less risk.

If maintaining the family farm system is important, farm income-support programs could be aimed toward giving more advantages to family farmers. Farm program benefits, such as direct payments to meet target prices, commodity loan provisions, or other direct benefits might be targeted more directly to family type farms. Strict low level limits might be established on the amount of federal payments that any farmer could receive per year. The program emphasis might be shifted from commodity price supports to maintaining farm family income. There would be administrative problems in implementing these policy options. To effectively influence the future structure of agriculture, farm income-support programs would need to be coordinated with other public policies which affect agriculture.

Tax Policies

Tax policies influence farm structure. Farmers are subject to the same broad range of federal, state, and local taxes which nonfarm individuals and business firms pay. Federal income tax provisions, including investment credit, fast depreciation of equipment and facilities, and capital gains tax rates designed to encourage business investment, also apply to the farm business. In addition farmers can use cash accounting not including inventory for tax reporting, which is advantageous to the expanding farm business.

Present tax policies encourage the enlargement of farms. Investment credit and fast depreciation allowances encourage investment in mechanization and farm expansion by reducing machinery costs for larger, higher income farmers. Capital gains tax rates encourage larger farmers and outside investors to invest in agriculture. Income tax and estate tax provisions encourage landowners and landholding families to hold their land, which creates difficulties for new farm entrants. Tax policies tend to significantly benefit present landowners but they make it more difficult for non-owner farm operators or beginning farmers to buy land. Present trends will lead to land ownership being increasingly concentrated among landholding families.

In developing future tax policies which affect farm structure, policymakers need to consider the type of farm structure preferred. Much of the current tax policy which encourages enlarging the farms applies to the nonfarm sector as well. Should changes be made selectively to apply only to agriculture?

If the public wants to encourage the continuation of the family farm and reduce the incentives for farm enlargement, a number of policy changes could be considered. Benefits from capital gains tax rates and investment tax credits might be reduced or eliminated. Provisions which allow writing off farm income losses against nonfarm income might be eliminated. Estate tax laws might be changed to reduce the incentive for "land-holding." Farmers might be required to use the accrual method of accounting which includes inventory. States might establish progressive property taxes to reduce farmers' incentives to expand.

Market Policy

The marketing system influences the structure of agriculture. Farmers depend on the farm input or supply markets as they produce crops and livestock and they depend on the farm commodity markets for selling their products. These two major market systems have developed in response to a changing agriculture.

Farm input markets have adapted and expanded to provide farmers with inputs for new technologies. Farm input firms can provide supplies and services to large farms at lower unit costs than to smaller farms. This gives large farms an economic advantage, though some farm supply cooperatives have effectively reduced the differences in input costs between large and small farms.

Farm commodity markets have also adapted to the changing farm structure. Contract arrangements and vertical integration (unifying a business from farm production through processing and marketing) have expanded in markets for products such as fruits, vegetables, poultry and beef. In beef and hog marketing, the open or terminal markets with competitive bidding are being replaced by direct market arrangements between the producer and the buyer, such as direct sales to processors and contract sales. Grain and oilseed markets depend heavily on open terminal markets, but farmers are increasing their use of forward contracts, futures markets, and negotiated direct sales. Except for the open market, these market alternatives are better adapted to larger farms, giving them some economic advantage over smaller farms.

If all sizes and types of farms are to have more equal market opportunities in the future, policies affecting the market system and its use might include maintaining a strong public market information system and assuring an open market system for all farm products, which might include the support of electronic marketing for particular commodities. Policies might also include providing a program to help smaller farmers use alternative marketing arrangements and strengthening the role of farmer cooperatives in both the input and product markets.

Public Research and Extension

Publicly supported agricultural research and extension educational programs have contributed to greatly increased agricultural productivity. Consumers have benefited significantly from this productivity, which makes a wide variety of food and fiber products available at relatively low prices.

Have research and extension programs encouraged farm enlargement? Most agricultural production research has been scale neutral. That is, the new technology has been adaptable to all sizes of farms, and extension information on technology has been available to all farmers. However, the more aggressive, better capitalized farmers are usually the first to seek out new information and to adopt new technology so they tend to gain more benefits. Part-time farmers have other major income sources so they place less priority on new farming methods. Small full-time farmers may have limited human and capital resources for committing investment to new technology.

Although most information from research and extension can be adapted to farms of various sizes, research and extension programs probably have facilitated the trend toward larger farms by making new technology available. This technology permits aggressive, expanding farmers to more efficiently organize their resources (land, capital, and labor) into larger units.

It is also important to recognize that research and extension have focused on the efficient use of resources in agriculture. Facilitating the transfer of excess agricultural resources, especially labor and capital, from farming to other alternatives has received only limited attention.

Future agricultural research and extension efforts need to be continued in the multiple areas which help the agricultural industry to increase production and respond to changing markets and consumer needs, but more research and extension work could be aimed at helping smaller and intermediate-sized farms to maintain economic viability.

Policies could encourage expanded research in technology and management particularly adapted to smaller and intermediate-sized farms. More research is needed on policies and economic factors that influence the structure of agriculture. Future extension programs could aim a greater share of their educational efforts in production and management at the moderate-sized family farm.

Family Farm Survival—Is It An Issue?

Should public policies aim at helping the family farm survive? American tradition has favored the family farm type of agriculture, and family farms still account for a major share of U.S. farm production. But larger and more specialized farms are now beginning to

dominate agricultural production. Public policies help shape the structure of agriculture and many current U.S. policies, though they were initiated to help family farms, have in fact encouraged change in the structure of agriculture. Our nation has benefited from this shift to a modern, productive and efficient agriculture, but it may not benefit from a continued shift to larger farms.

The present 2.4 million U.S. farms are characterized by extreme diversity. The current mix of specialized farms, large farms, intermediate-sized farms, small farms, and those operated by part-time farmers has resulted from economic and social forces and from various public policies. The pertinent issue is whether public policy should aim at creating an economic climate which will help the family farm to compete in a diverse agriculture. To be productive and efficient, a family farm must adopt new technology. Such a farm will probably continue to become larger but it will maintain the characteristics of a farm business operated by the farmer and his family.

The family farm can continue to be a viable part of the future structure of agriculture if the economic climate permits it to adapt to a dynamic industry. Public policies can help to provide this climate. Conditions favorable to continuing the family farm include: competitive access to land and capital resources, opportunities for farmers to improve management abilities, ready access to agricultural research and extension, reasonable income protection for family farms, easy access to markets, opportunities for off-farm employment, tax policies that do not place family farms at a disadvantage, and other policies adapted to the particular needs of farmers.

In our democracy, the public can decide what type of farm structure it prefers. Through the use of the political process citizens can devise policies to develop a

farm structure which will help to achieve our economic and social goals.

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Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Food for People and Profit: Ethics and Capitalism

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"The suggestion that America's system can work without anyone having good motives — without public-spiritedness — gives people an easy conscience about pursuing private interests through public policies." — George F. Will

"Present-day society [is] 'rent-seeking,' everyone out for incomes in excess of what can be earned in a competitive market." — Anne Krueger

ALMOST 20 YEARS AGO the National Commission on Food Marketing summarized the findings of its study of the food marketing system in these terms:

The American food industry . . . represents one of the outstanding achievements of the American economy.

[It] has developed under a system in which individual business firms have made virtually all operating and investment decisions within general limits established by public policy. . . . The role of Government has been to provide certain services and to establish rules to assure that the competitive system operates in the interest of the public and of the industry itself.

Our studies have convinced us of the vitality of the food industry. . . . [However,] we are of the view . . . that a truly competitive environment, appropriate services to consumers, and equity for producers can be more fully assured by certain modifications of existing statutes, regulatory activities, and governmental services. . . .^{1*}

As the quotation indicates, the Commission gave the food industry a high mark. It also noted exceptions and opportunities for improvement. In academic terms, the Commission assigned a grade of about B+.

That overall judgment is still valid today. The food marketing system performs technological marvels. How well it meets welfare criteria for all its members — producers, consumers, and marketers themselves — is less certain. Most disputes about the system revolve around that question, not around technical performance.

Faith in Competition

The Food Commission was indeed dedicated to the principle of competition. The food industry that the Commission endorsed with reservations is "a product of a competitive economic system." Such a system, the Commission was quick to note, "requires competitors." That is to say, "it works best when the number of competitors is sufficiently large so that they impose mutual restraints on each other, with the result that their collective activities are guided along paths consistent with the public interest."

This axiom is the purest check and balance concept. The Commission stressed numbers first. It wanted many firms battling to serve farmers, consumers, and each other. In its text it also called for information, grading, and other traditional supporting services. The Commission did not inquire further into the meaning and significance of a competitive system for marketing the food products of agriculture. It did not emphasize how very demanding are the terms of a competitive system, or how hard — even guilefully — the participants in the system will try to manipulate it to their individual benefit.

The Heroics of Competition

The idea that individual producers — and individual consumers too — can interact competitively in a manner to drive and guide the economy to meet the objectives we set for it is heroic. It is almost otherworldly. The idea is heroic first of all because competition marshals not the nobler instincts of human beings but their selfish aggressions, yet it does so for primarily social purposes rather than private ones. Its object is not to enable the successful few to exploit all others, but to let all citizens contribute to social output and share in the consumption of that output.

It follows that competition is heroic because it succeeds socially only as it partially fails privately. It achieves social goals by means of individual frustration. Competitors try to outcompete their rivals, that is, to eliminate them. The system works only insofar as they fail to do so. Economic competition, unlike

*See Footnotes on page 20.

the law of the jungle, succeeds not primarily by elimination of rivals but through reciprocal checkmating. This is indeed heroic!

Economic competition is like a game of marbles. In the game, the object is for each player to win the others' marbles. But if one player wins all of them, the game ends. Competition in the economy continues only insofar as no competitor wins all the economic marbles. Quite literally, whenever too many economic marbles get into too few hands, it becomes necessary to introduce either social (governmental) control or programs to redistribute wealth and income.

The Object of Economic Competition

Competition is a process. It has form and substance but it does not itself establish objectives. The National Commission on Food Marketing endorsed the virtues of competition as a process and said a lot about how to improve its functioning, but it did not say why the process of competition was good in the first place or what common objectives are held for it.

Both economic writings and the mores of our nation say much about what we seek in our economic system, and therefore also in marketing the food products of our agriculture. As the title to this paper tells us, we want "food for people." For the reasons just named, we introduce "food for profit" — included in the title — not as a companion goal nor even as an alternate one, for it cannot be either. It is subordinate, instrumental. Profit enters into the system not as a goal for it but as an integral part of the competitive instrument.

At this point we get into one of the touchiest and most misunderstood principles in the economics of competition. Profit is morally ambiguous. What really counts is the *pursuit* of profit, not its realization. A modest rate of profit arising from its motivating role is not merely acceptable, but essential. Yet anything more than that is dirty, anti-social, and a threat to continuation of the competitive system itself.

What is meant by food for people, as our wish for the food system? In simplest terms, what we want is to utilize our resources for producing and distributing food in a manner that balances the twin goals of meeting at least the minimum needs of human beings and rewarding participants proportionately to their contribution. These are two goals, not one. Often only the second is named, and it is frequently couched in terms of marginal return for marginal contribution. To address only the second goal is wrong. We must always recognize both.

The most obvious example of meeting basic needs for food irrespective of economic contribution is that of individuals who are unable to earn enough income to buy the food they need. They may be unable to do

so because of physical handicaps, or because the economy is in recession and does not offer opportunities for employment. So it is that we provide for orphans, the aged, the infirm, the emotionally unstable. We soften the consequences of industrial unemployment by means of unemployment insurance, food stamps, and other grants that make it possible for individuals to have food even though they lack the wherewithal to buy it.

We do not confine our humanitarian consideration to our national boundaries. We give a modest amount of food to poor people of other nations or sell it to them at a concessionary price.

Enhancing the Capacity to Produce and to Buy

The second of the twin goals is fundamental. Its simple phrasing can hide its significance. Making it possible for individuals to earn food via their own economic contribution is a grand principle. But how can it be realized? In particular, how can people develop the capacity, and be assured the opportunity, to earn incomes that will enable them to buy food for a good diet? This is a powerful question and as such it gives rise to major public issues.

In our high technology world, individuals are not natively equipped to be productive. They must be trained, educated. And the door of opportunity must be opened, allowing them to use their talents. It's a tall order!

It is worth noting that competition is not only a process, but pretty much a process of the moment. It does not project well in time, backward or forward. It deals better with events in the here-and-now than with futurity. Yet education is futuristic. To develop the capacity of individuals to produce, and thereby to be able to consume, requires action outside the competitive sphere. It calls for social — public — action.

Competition falls short, too, of bringing about the development of physical resources that have long-term benefits. Hydroelectric facilities are a familiar example. In food production, conservation of the soil resource is equally illustrative. Some conserving practices yield contemporary returns to the farmer who performs them and the competitive system can be relied on to bring such practices about. But others require installations that are more in the interest of future generations than of the farmer of today. We can get them only if we invest socially — via government.

Another feature of projects to develop physical resources is that their benefits often cannot be channeled solely to the sponsors but become social property instead. This is a second reason for using public funds for hydroelectric development, highways, public health services (such as spraying for mosquitos), and agricultural experiment stations.

This is the principle of externalities. Competition, being a private process, works well only to reconcile costs and benefits that are internal in nature. It does not bring about spending for public benefit — positive externalities. If unrestrained, it can also lead to action for private benefit which causes social injury — negative externalities.

The Burden of Information

A competitive food system imposes yet another requirement for its effective operation. It is the requirement of information. Knowledge is the necessary companion of high technology. As our food system is now one of complex techniques and many highly processed food products — indeed, some fabricated ones — it will work well only if accurate information about it is disseminated widely. Information ranges from market news to product labeling to providing data about opportunities for investment and employment.

Informational services are engaged in both privately and by agencies of federal and state governments. A public role is essential and it definitely must counteract damaging misinformation that may be put out privately.

Institutional Complexities

Still another consideration enters into the attractive principle that participants in our economy shall earn their food by means of rewards they get for their own economic performance. It is that everyone who works (or manages, or invests) must therefore be paid off accurately in line with his contribution, and further that the products that are produced (food in this case) must be priced in line with cost of their production. In other words, the principle carries a heavy institutional obligation. It is the obligation of accurate pricing of services contributed and of products produced and sold. It permits no anti-competitive practices that distort the pricing process.

This condition is met most readily in an economy of small entrepreneurs selling their products in open markets. A soybean farmer who gets 30 bushels of beans per acre can live better than one whose harvests average 20 bushels. A cobbler who makes one pair of shoes in a day can buy more beefsteak than one who requires a day and a half.

Only a small part of the economy of today works that way. Instead, it is highly institutionalized. Many wage rates are negotiated in collective bargaining. Prices of most industrial products, including processed foods, are arrived at not in open auction but “administratively” — that is, by administrative decision in a corporate business. This is not to suggest that the many ways wages and prices are determined nowadays are suspect, or that they always violate the

principle of reward commensurate with performance. But they could fall short of what is desired.

Moreover, most processed food products are now turned out by firms that produce a large number of products by using large, costly capital installations. In other words, they are highly capitalized industrial firms. To say that products shall be priced equal to the cost of inputs used in their production is an empty phrase, because so much of the cost structure spreads over many products or over an indeterminate number (of units) of a given product. Theoretical economists have tried to resolve the puzzle by inventing a formula for equating costs and returns “at the margin.” But the marginal cost of producing an automobile, a cotton shirt, or a one-pound can of luncheon meat depends on whether it is the thousandth unit to come off the production line and be sold or the ten-thousandth.

Furthermore, as was observed above, every person and firm in the system tries to avoid having his services priced at the margin. We may teach in our economics classes that marginal-product pricing characterizes the marketing system for farm products. It would be more accurate to say that marginal pricing is carried on wherever it cannot be avoided.

Where, and how often, textbook-competitive pricing “at the margin” is engaged in is a question of empirical fact, to be determined only by observation. The principle being explained here is that persons and firms behave competitively only insofar as the competitive makeup of the system forces them to do so.

To repeat, these reminders of the flaws and complexities in the system for marketing farm products do not indicate general disapproval of the existing system. They do warn against making easy judgments about whether our food system effectively and efficiently produces food for people.

Particularized Judgments

This essay addresses the principles — the ethics — of our food system and is not itself an evaluation of the system now in operation. A question naturally arises, though, about how well our system of today conforms to the idealized criteria that have been established for it.

No all inclusive, sweeping judgment will be offered. If one were necessary, it would be about the same as what the National Commission on Food Marketing said nearly 20 years ago. The system accomplishes wonders. It also has its faults, failures, imperfections.

But all marketing is of a particular commodity done by a single marketer at a given time and place. The appropriate question is how well that selected transaction is carried out.

If a Tennessee cattle feeder must accept below-

market prices for his cattle owing to quiet collusion among local buyers, if a food processing industry is so oligopolistic as to overprice its product, if a small food firm is frozen out by a big competitor's sales below cost, the deficiency in each case is genuine and harmful, irrespective of the praise that may be sung — perhaps with good cause — about the system as a whole.

It is possible that we expect too much of our marketing system. Even as the system becomes more complex, as noted above, and therefore harder to evaluate, we raise our expectations for it. Environmental concerns are an obvious example of a sensitivity that is now sharp. In earlier years such sensitivity amounted to little more than making sure milk bottles were scalded before being filled. In a good resume of concepts and techniques in studying market performance, Marion and Handy write that not only are performance parameters now hard to estimate accurately, but that performance has become “multidimensional.”²

Probably everyone feels fairly comfortable about judging the quality of markets at the farm, where crops or livestock are sold in open trading and many buyers compete to buy a standard product. Marketing of that kind is textbook-traditional; it is understood well, and any flaws are readily observed. But the largest part of the food marketing system is of a different makeup. At later stages firms are fewer, products are differentiated, and prices are arrived at not in open auction but “administratively.” This part of the marketing system is sometimes called merchandising-oriented. In technical economic terms, competition is imperfect. It is harder to judge the performance of merchandising-oriented marketing than of traditional markets near the farm.

Eternal Vigilance to Monitor the System

Finally, the marketing system for food will be a system of food for people only if its performance is monitored to make sure it functions that way. The monitoring is necessarily done by government. The role of government is essentially to provide supporting services and set rules. Most of the services are of long standing and not generally in dispute. They have been catalogued often.³ The repertory is familiar: market information, grading and standardization, promotion, research, provision for group action (as farmer marketing cooperatives), and trade practice regulation, including protection of safety in foods.

The strongest instrument of government is anti-trust regulation. Such regulation can forestall or correct the most blatant violations of the many-firm competition that the Food Commission regarded as

integral to our food marketing system. Unless government does that, there can be no hope for a truly competitive food marketing system that achieves the idealized goal of food for people.

If participants in marketing are allowed to act competitively without restraint, either the goals of the marketing system will not be met — or a governmentally regulated system will eventually prove necessary.

Yet from a different point of view the basic issue, in the final sense, is not one of private vs. public confrontation. Instead, we find here the ultimate contradiction: the wisest and most effective action taken by government to keep the food marketing system efficiently competitive will in fact reduce the governmental presence.

To put it differently, a competitive food marketing system can effectively do just about everything except provide for its own preservation. Only a public involvement will establish the terms of competition and institutional structure to enable the system to be essentially private yet act to provide food for people — and thereby earn its own continuity. A system that performs well is self-sustaining without need for further public action.

Let it be said once more. To expect a marketing system driven by pursuit of private profit to provide food for people is nothing less than heroic. It is heroic because the participants individually seek other goals. They strive not merely for a normal or necessary profit but for more than that. As Anne Krueger observes in an opening quotation, they are rent-seekers. They seek rent in any advantage they can get. Whether they are able to do so, collecting excess profit, or instead are mutually checkmated and act in the common interest, depends on the wisdom of the public action taken to keep the system competitive. It depends on whether a public concern is exercised responsibly. And the more responsibly that concern is exercised, the more private the system can be.

All of which testifies to the wisdom George Will expressed in an opening quotation. For the economic system to work someone must have good motives, public-spiritedness. In our democracy that “someone” must somehow manifest the nobler instincts of all our citizens.

¹National Commission on Food Marketing, *Food from Farmer to Consumer* (Washington, D.C.; U.S. Government Printing Office, 1966), p. 105.

²Bruce W. Marion and Charles R. Handy, *Market Performance: Concepts and Measures* (U.S. Dept. of Agriculture, Economic Research Service. Agricultural Economic Report No. 244, 1973).

³Walter J. Armbruster, Dennis R. Henderson, and Ronald D. Knutson, *Federal Marketing Programs in Agriculture: Issues and Options* (Danville, Illinois: Interstate Printers, 1983).

II. THE INTERNATIONAL DIMENSION

- **The Global Food System and the
Future U.S. Farm and Food System**
- **International Food Policy and the Future of
the Farm and Food System**
- **Trade and U.S. Food and Fiber System**

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

The Global Food System & the Future U.S. Farm & Food System

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THE VERY CONCEPT of a world food system is a relatively new and poorly understood phenomenon. Today approximately 85 percent of food is consumed in the country in which it is produced. In 1960, that percentage was approximately 90. The globally interdependent food and agricultural system is a product of the 20th century and for all practical matters, a product of the post World War II 20th century. This is not to say that food security was not a concern in the past or that famine and overproduction were not problems. Food shortages and surpluses have always been problems, but in the past very little could be done to alleviate their consequences. A global food system, in the true sense of the word, has existed only since the recent development of a world linked by sophisticated communications systems, international financial systems, international markets, rapid and relatively inexpensive intercontinental transportation systems, and a scientifically based agriculture in many countries.

Paradoxes within the Global Food System

The emergence of this interdependent global system has not resolved all of the world's food problems. The system is extremely complex, poorly understood, and can be forecast only with very poor reliability. It is also a system beset with paradoxes. For example, during the two years preceding 1983, the major food exporting countries of the world, the United States, the European Community, Canada, Australia, and Argentina, had produced huge surpluses of grains which had accumulated, largely in the U.S., as price depressing stocks. These stocks resulted in cutthroat competition among these exporting countries. While one part of the world was apparently drowning in surplus production, we were told that more people than ever before were suffering from hunger and malnutrition.

There is also the repetitiveness with which expert assessment of the outlook for world food supplies can and does change. At the 1980 USDA Agricultural Outlook Conference, the overriding theme was the concern

that the world would be able to feed itself during the latter part of the 20th century only at significantly increasing real prices for food. There were also concerns that the extraordinary pressure on the world's resource base necessary to meet these needs would overtax the environment and do irreparable damage to it. In contrast, at a symposium sponsored by Philip Morris, Inc., in April 1983, speaker after speaker expressed confidence that the world would be able to feed itself well into the 21st century without damaging the environment and without significant increases in real prices. How can expert assessment of future behavior of the world's food system change so radically in such a short period of time?

And finally, there is the paradox of the U.S. having implemented a massive payment-in-kind (PIK) program to withdraw resources from production and reduce burdensome levels of stocks of agricultural commodities. Yet during this fiscal year the U.S. will spend more than half a billion dollars to improve agricultural productivity in developing countries. Many ask why we should help other countries to increase their supplies of food while we are paying our farmers not to produce.

To understand how these seemingly inconsistent conditions can exist simultaneously or how perceptions and expectations can change so drastically in such a short period of time, it is necessary to understand the nature of the world food system. The world's food and fiber is produced and consumed within the structure of an interdependent, global market system. This market system is constrained by resource endowments, technology, general economic conditions, and policies existing in some 160 sovereign and spatially separated countries.

The primary purpose of this paper is not to forecast the future behavior of the world food and fiber system. Instead it is to describe the nature of this system and the constraints under which it operates. Some of the pressures that are likely to be placed on the system during the remainder of the 20th century will be discussed along with implications for the U.S. as an important component of this global food system.

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How Much Food is Enough?

This is not a simple question and the answer to it is not obvious. In fact, much of the disagreement about how well the world food system has performed and how well it is likely to perform in the future derives from differing views about how much food is enough and differing perceptions of how the world system responds to pressures for more food.

If we are to understand how the system determines how much food is enough, we must understand three basic points. First, the **need** for food is not the same as **demand** for food. Second, the world food system depends largely, but not totally, on markets for transmitting signals between producers and consumers. In markets, it is demand to which production and distribution respond—not need. Third, there is a spatial dimension to need and demand as well as to production. Costs are associated with transferring information and products in space.

Need for Food

The world's food situation is often discussed in terms of the current and future need for food and the ability of the world to meet that need. The concept of food need is useful in assessing the requirements for current and future nonmarket distribution of food to alleviate hunger, malnutrition, and human suffering. Comparing how much food is required with how much is actually consumed, to the extent that either can be measured, may be a useful criterion for evaluating the performance of agriculture in a particular country or even in the world. However, as a force guiding future performance of agriculture, the concept of food need is not terribly useful.

The aggregate food need of the world or of any particular country is a function of the per-person food consumption standard that is adopted and the number of people to be fed. Food **need** is a normative view of what food requirements would be if all people ate according to some standard.

Demand for Food

Demand for food, on the other hand, is an economic concept which says that people, individually and collectively, have multiple, competitive needs and desires that must be satisfied from a limited amount of purchasing power (money) and that, for most goods and services, the quantity that will be purchased will decline as the unit price increases. Thus the individual's demand for food is a function of his or her biological and nutritional need for food, preferences for different kinds of food, and ability and willingness to pay for food.

Given the selection of a good consumption standard, the need for food is directly related to population, and changes in population lead to changes in the need for food. Demand for food is normally considered to be

primarily related to population and per capita income. Of course there are many other factors which influence demand, including changes in preference and taste and changes in the availability and price of other goods and services. We will look briefly at the relationship between population and food demand and that between income and food demand before we review historical trends and ask what is likely to happen to these two determinants of demand for food in the future.

At first it would seem logical that so long as per capita income remained constant, each additional person would add an equal amount to demand for food. Essentially this has been the way economists have treated population as a factor in projecting food demand; that is, a one-percent increase in population leads to a one-percent increase in food demand. However, some experts have argued that this may have led us to overestimate the rate of growth in food demand in the low-income, developing countries with very rapidly increasing populations. Their reasoning is that in a rapidly growing population the average age of the population is declining. Since very young children require less food than older children and adults, a rapidly growing population would result in smaller incremental change in demand per unit change in total population. The converse of this argument is that as the rate of growth of population slows, the population distribution changes again and the average age increases (as, for example, is currently happening in the United States). In this case, young children become a smaller proportion of the population. Thus we may have tended to overestimate the effect a decreasing rate of population growth has on the demand for food.

The effect of income on food demand is more complex than that of population and is not so easily understood. However, several general relationships can be stated. Because food is necessary to sustain life, acquiring the minimum amount of food needed for survival claims a very high priority on income. Thus poor people spend a high proportion of their incomes on basic foods. Until income reaches a sufficiently high level to allow basic food requirements to be satisfied, a large proportion of any increase in income is spent on the increased consumption of basic food items such as cereals and vegetable proteins.

As income increases, the proportion of total income and of incremental increases in income spent on food decreases as people meet their needs for things other than food. Still total expenditure on food, and even the total quantity of food consumed, increases with income. During the process of upgrading the diet, the impact of rising food expenditures differs for different types of food. The effect of an income increase at higher income levels is small for basic food items such as cereals and larger for preferred substitutes. When income reaches a sufficient level, consumers substitute animal products

for vegetable products. Since several pounds of grain are required to produce one pound of animal product, the increase in feed grain demand far exceeds the decline in food grain demand. Thus total demand for agricultural products can increase very rapidly in a developing country as its population starts to consume meat.

Several important features of the relationship between income and food demand help to explain the behavior of the world food system. First, the effect of a given increase in per capita income on food demand depends on the prior level of income of those experiencing the increase. In a developing country just reaching the stage of consuming animal products, it could be very great. In a high income country (e.g., the U.S. or West Germany) it will likely have little or no effect on the demand for food *per se*. Second, the effect of income changes differs for different commodities—for example, meat vs. food grains. And third, the effect of income change on the demand for different kinds of products depends very much on the prior income level of the recipient.

Having looked at some of the more important ways in which population and income influence food demand, let's now review past trends in population and income and make some projections into the future. This will provide an indication of the future trends in food demand.

Population Trends and Projections

The world has witnessed a population explosion since World War II, with total population increasing by 76 percent during the period 1950-80. This was an increase of 1.9 billion people—from 2.5 billion in 1950 to 4.4 billion in 1980. Another way of looking at this explosion is that it represents an annual compound growth rate of almost 2 percent per year. On the average, more than 60 million people were added to the world's population each year.

The impact of such rapid population growth on food needs and food demand can be better understood by looking at where this growth occurred and how growth patterns in different groups of countries have changed over this period (Table 1).

Table 1—Growth of Population, 1950-80.

Region	Compound Annual Growth			Annual Increment		
	1950-60	1960-70	1970-80	1950-60	1960-70	1970-80
	Percent			Million People		
Developed	1.2	1.0	0.7	6.9	6.4	4.9
Centrally Planned	2.0	1.7	1.5	18.4	18.7	19.3
Developing	2.1	2.4	2.4	27.0	38.8	49.3
WORLD	2.0	1.9	1.8	52.3	63.9	73.5

Source: USDA Economic Research Service.

Several significant points should be noted:

- Growth rates have been highest in the developing countries of the world and lowest in the developed, industrialized countries.
- Growth rates have declined significantly in the industrialized and centrally planned countries and have stabilized in the developing countries. If the developing countries are further separated, we see that those with higher incomes (the middle-income developing countries) have also experienced a decline in rate of population growth during the last decade.
- Even though rates of growth have stabilized or declined, the absolute number of people being added to the population of all except the developed, industrialized countries has continued to increase because of the larger base to which the declining or stable growth rates apply.
- During the decade of the 1970's, for the first time in recent history, the population of the less developed countries represented more than half of the world's population.

The population explosion in the developing countries over the last three decades resulted generally not from increasing birth rates, but from continuing high birth rates combined with rapidly declining death rates. Death rates, especially among infants, were reduced very sharply after World War II as new and effective means of fighting many diseases were successfully introduced in the developing countries and population mushroomed. As the disadvantages of such rapid population growth were recognized, many countries launched family planning and other types of population control programs with varying degrees of success. Also, as economic conditions improved in many countries, the desired number of children declined. As a result, birth rates have declined significantly in many developing countries during the last two decades. The most striking declines among the low-income developing countries have occurred in China (50 percent) and India (19 percent), but even the remaining low-income countries have experienced a 10 percent decline in birth rate. The middle-income developing countries as a group have achieved a 19 percent decline in birth rates.

Population experts expect the decline in birth rates to continue. As death rates and life expectancies in developing countries approach those of the developed countries, lower birth rates will have a greater effect on population growth rates. It is projected that between 1980 and 2000, the developing countries as a group will grow at an annual rate of about 2 percent. While a 2 percent rate is still very high compared to an expected rate of .5 percent in the industrial countries, it is a very significant improvement over the rates of the 1960's.

While the rate of growth is expected to decline during the last two decades of this century, the absolute numbers added each year will continue to grow and

most of the increased food need which results will be in the developing countries. It is likely that with constant per capita income, world demand for food will increase at a rate of less than 2 percent per year.

Income Trends and Projections

The post World War II period was not only a time of unparalleled population growth but also a period of rapid economic growth. In fact, economic growth was more rapid than population growth, resulting in significant increases in per capita income (Table 2). Average per capita incomes rose at a relatively rapid rate on a global basis and almost all countries participated in this growth. Unfortunately, the few exceptions were very poor, developing countries in which income is the most serious constraint on food demand.

Table 2—Growth of GNP Per Capita, 1955-70, 1970-80.

Regions	Compound Growth Rates	
	1955-70	1970-80
	Percent	
Developed	3.6	2.4
Centrally Planned	5.8	2.8
Developing	3.1	3.1
Low income	1.6	2.4
Middle income	3.5	3.1
High income	4.7	3.3
WORLD	3.1	2.6

Source: World Bank and USDA Economic Research Service.

The growth in per capita income in the low-and-middle-income developing countries and centrally planned countries had a great impact on food demand. In the low-income countries higher income led to significant growth in demand for basic food items such as food grains and vegetable oils. The middle-income developing countries and the centrally planned countries reached income levels permitting consumers to substitute animal protein for vegetable protein and to upgrade the quality of their diets in other ways. In these countries the rising demand for animal products caused the demand for feed grains to grow rapidly.

Increased incomes in the high-income countries had a much smaller impact on demand for food. However, not all people in the high-income countries earned high incomes. Thus, even in the high-income countries economic growth, to the extent that it was shared by the poorer segments of society, contributed to increasing food demand.

The trend in per capita income established over the period 1950-80 has been interrupted by the worldwide recession of the early 1980's. During this recession economic growth has been very slow or stagnant in most countries and has even been negative in some. With continuing population growth, per capita income growth

has slowed even more severely than aggregate income. Thus income growth has contributed very little to food demand early in this decade.

Most economic forecasts predict world economic recovery but state that economic growth will be significantly slower than during the preceding three decades, at least until the latter part of the 1980's. If these forecasts prove correct, income growth will contribute less to growth in food demand than it did during the previous 30 years.

Trends and Forecasts for Food Demand

While they are important, population and income are not the only factors which affect the demand for food in the world. Income redistribution and food price policies of governments have also had a significant effect on this demand. Many countries, including the U.S., have adopted policies to redistribute income to the poorest segments of their populations. These include welfare and social security programs and unemployment insurance. Others, especially many developing countries, have adopted cheap-food policies utilizing various combinations of subsidies and price controls. The wealthier countries, including the U.S., provide food aid to the low-income countries. All of these policies result in a larger part of food need being transformed into effective demand and in the aggregate demand for food being greater than it would otherwise be for a given population and income level. Also several centrally planned countries, including the Soviet Union, have modified their policies in order to upgrade the diets of their people.

During the period from 1950-1980 the combined effects of population and income growth and policy resulted in an average growth of 2.8 percent per year in world food consumption. This was a very rapid rate—nearly twice that of the first half of this century. The outlook for the remainder of the century is mixed—experts disagree in their forecasts. Nevertheless, it is clear that food need will continue to grow rapidly. While birth rates are expected to continue declining so are death rates. Even though the rate of population growth will continue to slow, the changing age distribution will increase per capita food need so as to offset much of the effect of slower population growth.

How much of the growth in food need is translated into effective demand will depend on (1) the rate of economic growth, especially in the poor developing countries, (2) the distribution of income within countries, especially as this results in sizeable segments of populations moving into income groups able to increase their consumption of animal products, (3) food and income policies around the world, and (4) the willingness of the high-income countries to provide food aid. If effective food demand is to grow at rates comparable to those of the past three decades, a strong and sustained

recovery from the worldwide recession of the early 1980's will be required, and the low and middle-income countries will have to participate fully in the recovery. Also, it must be remembered that food policy decisions in the USSR and other centrally planned countries to increase food consumption, even if increasing it meant importation, contributed significantly to past growth in food demand. No other such drastic policy change can be foreseen at this time. It appears that even a conservative forecast of future economic growth would result in food demand growing at about 2 percent per year and an optimistic forecast of economic growth could result in food demand growing at more than 2.5 percent per year.

Even under the most optimistic economic growth conditions, a large gap between food need and the ability to translate this into effective demand will continue. This gap will be most serious in poor developing countries with rapid population growth and slow, unevenly distributed economic growth. There is little question that this disparity will continue to grow until near the end of this century. There will, therefore, be a continuing need for large and growing domestic and international income transfers to fill this gap and to reduce hunger and malnutrition.

We have explored likely future trends in global food need and demand. It is now important to look at global food supply from an historical perspective, consider the major factors determining supply, and speculate about future supply that may be available to meet demand.

How Much Food Can Be Produced?

Like the preceding question, "How much food is enough?" this one is complicated and difficult to answer. The best simple answer that can be given is, "It depends on the price that consumers are willing to pay." At first this may not appear to be a very helpful reply, but it does provide a useful basis for looking at the factors that determine the world's ability to meet future demand for food.

Supply, like demand, is an economic relationship which is not easily observed. The supply of any commodity is the quantity that producers are willing to produce at a particular price. In general, producers are willing to supply larger quantities as the price increases. What we actually observe is the availability of a commodity which consists of current production and stocks. Production and stocks are the result of the joint forces of supply and demand and of uncontrollable factors such as weather. Production is a technical phenomenon. It is influenced by the economic forces affecting producer decisions which determine supply but it is not the same as these forces. This distinction is important because of the tendency to think of the factors controlling the potential for production in fixed physical terms

which place absolute limits on the potential to expand production.

Thinking of production as a biological process which utilizes land, water, and labor combined with manmade capital under slowly changing technology has generally led to the conclusion that there is a maximum capacity for food production. In a physical sense there is, of course, an absolute limit to the amounts of land and water available and with a given level of technology, a limit to the amount of food that can be produced. It is often noted that there are not new continents to be discovered; that most of the best agricultural land in the world is already farmed; that most available irrigation water is being used, and in some important instances, ground water reserves are being depleted at a rapid rate; and that yield increases seem to be slowing.

However, this view of production potential places too much emphasis on physical quantities of resources and too little on economic forces. Such forces provide strong incentives to reduce the use of scarce and costly resources by developing and substituting cheaper inputs, thereby expanding production potential. As land becomes scarce, more intensive ways of using it are developed. For example, fertilizer and other chemicals combined with more responsive crop varieties and irrigation allow more of a given crop to be produced on the same amount of land. Nonproductive land is made productive by drainage or irrigation or terracing or by the introduction of new cultural practices or new crop varieties. Thus as physical resources for food production become scarce, economic forces come into play. Such forces lead to more efficient use of resources and to the discovery of more and better substitutes for them.

In addition, resource scarcity leads to the actual or anticipated scarcity of food. This results in an increase in the price of food and thus an increase in the economic return to resources used in its production. With higher returns it becomes profitable to bring into production resources that were previously uneconomic to use. Often bringing these marginal resources into production requires investments such as clearing, leveling, draining, or irrigating land; developing roads, communication systems, irrigation systems, or storage and marketing facilities; or developing new techniques of production. These tend to be fixed investments which have long productive lives and relatively low maintenance costs. Once these resources are brought into production they may be no more costly to keep in production than others. Thus temporary resource scarcity may bring forth a burst of investment in new productive capacity which overshoots current demand, and for a period of time food prices may return to their previous levels or even lower ones.

The important point is that productive capacity is not a fixed, God-given endowment, but a flexible constraint that can be expanded over time through investment in response to normal economic forces. World food pro-

duction trends during the post World War II period show that these forces have worked quite effectively.

Trends in World Food Production

While much has been made of the post World War II population explosion and the world food problem resulting therefrom, the facts concerning this issue are encouraging. During the period 1950-80, world agricultural production (excluding that in the People's Republic of China) grew at an average rate of 2.5 percent per year. This rate of growth not only was sufficient to keep pace with population growth but exceeded it by enough to provide for an average annual rate of growth in per capita production of .7 percent (Table 3). Thus the world's much larger population was, on the average, better fed in 1980 than in 1950.

Equally as important as the aggregate performance of

world agriculture are two characteristics of this performance. First, the rapid and sustained growth was broadly shared among countries and regions of the world— developed, developing, and centrally planned. With the exception of Africa, every major grouping of countries increased per capita agricultural production.

The second important and encouraging characteristic is the source of this growth. Of the total growth in agricultural output between 1950 and 1980, approximately one-fourth was derived from the increased area of land under cultivation and the remaining three-fourths from increased productivity (higher yields).

Potential for Future Increases in Production

The rate at which world agricultural production will increase during the remainder of this century will depend on several factors, including:

Table 3—Growth of Agricultural Output by Major Regions, 1950-80.

Region, country, group	Compound Annual Growth							
	Total				Per capita			
	1950-80	1950-60	1960-70	1970-80	1950-80	1950-60	1960-70	1970-80
	Percent							
Developed	2.1	2.6	2.1	1.9	1.1	1.3	1.0	1.1
Centrally Planned*	2.3	2.4	2.9	1.7	1.2	0.9	1.8	0.9
Developing	2.9	3.3	2.9	2.8	0.6	1.0	0.4	0.3
Africa	2.3	2.6	2.3	1.5	-0.3	0.3	-0.3	-1.3
Middle East	3.4	4.7	3.5	3.6	0.6	2.1	0.9	0.9
South Asia	2.5	2.9	2.1	2.3	0.5	1.2	-0.1	0.1
East Asia	2.7	3.9	2.2	2.4	0.5	1.7	0.2	0.5
Latin America	3.2	3.6	2.8	3.2	0.8	0.9	0.4	1.1
WORLD	2.5	3.2	2.6	2.2	0.7	1.2	0.6	0.4

*Excludes the People's Republic of China.

Source: USDA World Agricultural Production Indices.

Table 4—Estimates of World Arable Land in 1970 and Potential Increase.

Region ¹	Arable Land			
	1970 base	Ultimate potential	Potential increase	Distribution of increase
	Million hectares			Percent
Developed countries ²	660	854	29	18
Latin America	127	586	362	43
Middle East/Africa I ³ (oil producers)	59	87	48	3
Middle East/Africa II ⁴ (generally arid)	83	161	94	7
Africa (other, tropical)	92	282	206	17
Centrally planned Asia ⁵	131	201	54	7
Asia (other)	278	330	19	5
TOTAL	1,430	2,501	75	100

¹Comprises a sample of 125 countries. Countries with extremely limited agricultural potential and island and city states are excluded.

²Australia, Canada, Europe (Eastern and Western), Japan, New Zealand, South Africa, United States, and USSR.

³Algeria, Iran, Iraq, Libya, Nigeria, and Saudi Arabia.

⁴Chad, Arab Republic of Egypt, Ethiopia, Israel, Jordan, Lebanon, Mali, Mauritania, Morocco, Niger, Somalia, Sudan, Syrian Arab Republic, Tunisia, and Upper Volta.

⁵China, (including Taiwan), Mongolia, Democratic People's Republic of Korea, and Vietnam.

Source: Derived from data in Alan M. Strout, *World Agricultural Potential: Evidence from the Recent Past*. Discussion Draft, Massachusetts Institute of Technology (Energy Laboratory) and Resources for the Future, Inc., March, 1975.

- availability of the land and water resources that can be brought into production,
- development and adoption of yield-increasing technology,
- investment in physical and institutional facilities to support agriculture, especially in the developing countries,
- government policies and economic incentives.

Land and Water

There is a significant amount of potentially arable land that can be brought under cultivation (Table 4). There are approximately 2.5 billion hectares of potentially arable land in the world of which approximately 1.4 billion hectares were being cultivated in 1970. There is, then, the potential to expand cultivated area by about 75 percent. The unexploited potential for increasing cultivated crop area is unevenly distributed geographically. The greatest potential is in Latin America with 43 percent of the world's potential increase. Tropical Africa and the developed countries account for another 17 percent each while Asia, the Middle East, and arid Africa have relatively little potentially arable land not being utilized.

Much of the land available for expanding cultivated crops is currently used for livestock grazing or is in forest. Also, much of it will require significant investment for conversion to cropland. A large part of the potentially arable land is in tropical zones where production technology for major grain and oilseed crops is not well developed. Much of the land is in semiarid zones where rainfall is marginal and variable. Thus while land is available to expand cultivated area, only strong economic incentives will bring it into production. Since much of the available land is in marginal climatic zones, crop production on it is expected to be quite variable and therefore economically risky.

The world's water resources available to expand irrigated agriculture have not been adequately inventoried. Experts often note that most of the favorable and economically attractive sites for large-scale surface-water irrigation systems have already been exploited and that, in a number of countries, groundwater reserves are being depleted. However, water can be used much more efficiently than it now is and currently utilized water sources can be used on much larger areas of land. Adopting more rational water policy and water pricing strategies and more efficient irrigation systems would permit many countries to expand irrigated areas greatly without using more water. There is also the potential for using more supplemental irrigation in more humid areas where water is plentiful but the distribution of rainfall is less than optimal.

On balance it appears that availability of land and water will not constitute a serious limit to expanding food production for the remainder of this century.

However, institutional and economic forces may limit the degree to which growth in food production will result from expanded land and water use. It may be cheaper to increase production by using existing land and water resources more intensively rather than by bringing more resources into production.

Development and Adoption of Yield-Increasing Technology

Existing technology and scientific knowledge offer tremendous potential for further increases in crop productivity. The large gaps between crop yields among countries that have adopted different levels of input-intensive technology, as well as the gaps between yields under experimental and average-farm conditions in most countries, indicate this potential. History has demonstrated that, given adequate incentives, farmers the world over are quick to adopt new technology. Thus we can expect continued rapid increases in crop yields to provide growth in output through the remainder of the 20th century.

There are, however, potential impediments to the adoption of new technology. A large part of the stock of technology "on the shelf" has been developed in the industrialized, developed countries to take advantage of their largely temperate climates and the relative factor prices consistent with their specific resources. Adaptive research will be required to modify this technology to fit conditions of the less developed countries. The international research centers are essential for this adaptive process. But they must be complemented by stronger research institutions in the individual countries. Also, much technology was developed during an era of relatively cheap petroleum energy and is thus energy intensive. The future of petroleum prices is uncertain, but most experts anticipate increasing real oil prices toward the end of the century. Most new technology depends on high levels of purchased, modern inputs such as improved seed, fertilizer, pesticides, herbicides, and machinery. Many of the less developed countries simply do not possess adequate infrastructures to support modern agricultural technology. Therefore modernization of agriculture in these countries will have to be accompanied by development of their agribusinesses and improvement of their communication and transportation systems. The barriers to increases in productivity based on the existing stock of knowledge appear to be mainly economic and institutional rather than technical or biological.

Investment in Physical and Institutional Facilities

Continued rapid growth in world agricultural production at rates sufficient to improve per capita food supplies will require large and sustained investment in facil-

ities to support agriculture. This is especially true in the less developed countries of the world.

As they adopt modern technology, farmers in the less developed countries will become increasingly dependent on nonfarmers for farm inputs, markets and market services, and technical information. As agricultural productivity increases, larger proportions of crops are marketed. Thus market information, market facilities, and good transportation become much more important. Increasing dependence on outside information and a more rapidly changing technology place increasing importance on the farmer's ability to gather, process, and use complex information. Thus an educated farmer becomes increasingly important to sustaining productivity growth.

The need for investment in roads, dams, and communication systems is rather obvious. The need for investment in institutions such as schools, an effective extension service, and research stations is less obvious, more difficult to demonstrate, and more often neglected. Other facilities such as marketing firms, input supply systems, and market information must also be provided.

What this really implies is that sustained growth in crop production in the less developed countries will depend heavily upon the economic development of these countries and, in fact, will be an integral part of this process. In contrast to the developed countries which already have good supporting systems, the less developed countries are shortest of the very elements most critical to creating such facilities.

Policy and Economic Incentives

It has been clearly demonstrated all over the world that farmers, businesspeople, and investors are economically rational. That is, farmers will invest in additional machinery, use resources more intensively, and adopt new technology, businesspeople will provide new services, and investors will make capital available when they perceive it to be in their best interest. Thus, it is important that the signals transmitted through the economy, especially through product and factor prices, be the correct ones. This is true whether price is determined by forces of supply and demand in a market economy or by government agencies in a centrally planned economy. Signals are "correct" when prices accurately reflect the relative scarcity value of products, services, and resources in the economy.

Government plays a critical role in establishing policies and maintaining an economic environment which gives correct signals to decisionmakers, including consumers. First and foremost there are a number of services critical to the provision of "correct" economic signals that normally will not be provided at an adequate level by private enterprise, even in a market economy. Such services, known as "public goods,"

facilitate the transmission of correct signals. They include providing data and forecasts of production, demand, and prices; establishing rules and regulations necessary for orderly functions of markets; and establishing and enforcing grades and standards. Producers find it difficult to control access to these goods and services or to reap the full financial returns on them. Therefore private business tends to underproduce them. Normally the government has to produce these services or at least control the production of them.

Most countries seem to treat agriculture, food production, and farmers as a special component of the economy—one that is so important it must have its own special set of policies. In some countries these policies generally support and protect agriculture—examples are those of the United States, the European Economic Community, and most other developed, industrialized countries. Other countries have adopted policies intended to favor the consumer at the expense of agriculture—ironically these tend to be less developed countries where agriculture is least advanced, where population is growing most rapidly, and where it is most important to expand the food supply. Policy tools which favor agriculture include price supports, subsidized credit, target prices and deficiency payments, and protection against imports. Policy tools which favor the consumer rather than the producer, commonly referred to as "cheap food policies," include price controls, taxes on agricultural exports, subsidized distribution of imported goods, and taxes on inputs.

The important point is that both these kinds of policies distort the signals received by producers, consumers, and investors.

General economic policy influences the signals received by farmers and agribusiness people as well as their performance. Tax policy can significantly influence the relative prices of factors used in production as well as of products. It therefore provides incentives or disincentives to use certain factors or product mixes. Monetary and fiscal policies influence the rate of economic growth, the availability and cost of capital, and the rate of inflation—all of which have important implications for decisions about production and investment in agriculture. These policies also help to determine the value of domestic currency in world exchange markets and thus to determine how competitive a country's products will be in world markets.

Trade policy, exercised through systems of tariffs, quotas, export taxes, subsidies, exchange rate manipulation, and other interferences with trade, affects the demand for domestic production and thus affects the prices received by producers and their incentives to produce more or less. A nation's agriculture is influenced not just by trade policies specific to agriculture but also by general trade policy.

In summary, it appears reasonably clear that the

global agricultural and food system has the natural resource base and the potential for increases in productivity necessary to meet food demand and the need for food well past the end of this century. The more important question is whether governments will adopt policies which transmit correct signals to producers, and whether public investments in physical and institutional resources will provide an environment conducive to expanding food supplies.

Production-Consumption Gaps and Growing Dependence on Trade

The explosive growth in international agricultural trade has been the most striking change in the world food system during the post-World War II period. During this period of increased trade most countries in the world have increasingly depended upon a relatively few exporting countries to fill the gap between production and consumption. During the 1950-80 period, trade in agricultural products grew at an annual compound rate of 4.5 percent, almost twice the rate of growth of production and consumption (Table 5). While world production of food and feedgrains increased by 72 percent between 1961-63 and 1979-81, trade in these commodities grew by 213 percent. During this same period trade as a percentage of production for these commodities increased from 11 percent to 17 percent.

Table 5—World Agricultural Production, Consumption and Trade Growth Rates.

Item	Compound Annual Growth Rates		
	1950-80	1950-72	1972-80
	Percent		
World:			
Production	2.5	2.8	2.2
Consumption	2.5	2.8	2.2
Trade	4.5	3.9	4.8
Per capita production	0.7	0.9	0.4

Source: USDA Economic Research Service and *FAO Trade Yearbook*, various issues.

As the quantities of agricultural products in international trade increased rapidly and trade became a much more important link among the food economies of various nations, significant shifts in trading patterns occurred. In general, the less developed and centrally planned countries became more dependent on food imports and on imports from the developed market economies (U.S., the European Economic Community, Canada, and Australia). These countries also exported fewer agricultural products to the developed countries. At the same time agricultural trade among the developed countries grew in relative importance. For example, during the 1956-60 period, 56 percent of developed country

agricultural imports came from other developed countries and 40 percent from less developed countries. By the 1976-79 period these percentages had changed to 67 and 29 percent respectively. The centrally planned countries depended on each other for 62 percent of their agricultural imports in 1956-60 and on the developed countries for only 18 percent. By 1976-79, these percentages had changed to 36 and 28 percent respectively.

Increased Trade and Shifts in Trading Patterns

The forces that brought about the rapid growth in agricultural trade and shifts in trading patterns were both economic and policy-related. While the less developed countries increased production per capita, they experienced even more rapid demand growth as per capita income increased significantly. Demand growth was further fueled by policies designed to keep food prices artificially low. These same policies tended to suppress domestic production and create even more excess demand which was filled by imports. The availability of foreign exchange grew rapidly in many of the less developed countries as exports of both nonagricultural raw materials and manufactured goods increased. During the 1970's, prices of raw materials were relatively high, especially for metals and petroleum. Also credit was readily available, often at subsidized interest rates, from international and national lending institutions and from the developed exporting countries. All of these forces converged to convert many less developed countries from net exporters of food to importers of it.

The centrally planned countries experienced rapid income growth but their populations grew much more slowly than those of the less developed countries. However, the major factors contributing to their rapid import growth were policy related. The USSR and Eastern European countries made a conscious policy decision to increase the availability of food, especially of animal products, to improve the quality of their people's diets. Accomplishing this goal required large imports of feed grains to support greater numbers of livestock. The People's Republic of China also decided to adopt a more open relationship with the western world and to utilize trade, including agricultural imports, to further its development. The policy decisions of the centrally planned countries were a very significant factor in the explosive growth of world agricultural trade during the 1970's.

The developed countries experienced rapid economic growth, slow population growth, and because they already had high income levels, relatively slow growth in demand for food. Japan was something of an exception. Its demand for wheat and red meat grew rapidly because consumers with rapidly growing incomes diversified diets previously based largely on rice and fish. Agricultural production grew much more rapidly in the developed countries—especially in the United States,

the EEC, Canada, and Australia—than did demand. This rapid growth in production was in part a response to market signals which reflected growing world demand, and in part a reaction to internal agricultural policies which raised domestic prices above world market levels. In both cases growing foreign markets provided a welcome outlet for surplus products, allowed farmers' productive capacities to be utilized, and made it much less costly to maintain farm income at politically acceptable levels.

Effects of Domestic Policies on World Trade

While agricultural trade has gained importance to the major exporters during the past two decades, none of these exporters have adopted an explicit, consistent trade policy. Most of them have focused on domestic farm and food policy and that has shaped their trade policy. An example is the European Community, which uses price policy to maintain high farm income levels. This results in internal prices which are often higher than world market prices. It also results in prices that are high enough to stimulate more production than can be absorbed domestically at such high prices. This domestic price-income policy is supported through a set of trade policies which insulate both domestic producers and consumers from world markets. Variable tariffs protect the producer from lower priced foreign competition. Production which cannot be absorbed domestically at official prices is exported with whatever subsidy is required to move it. During periods of unusually high world prices consumers are protected by subsidized imports which maintain official prices.

The U.S. has also focused on domestic farm policy in order to stabilize prices (provide a safety net) and support incomes in agriculture. This policy includes the use of price supports, income payments, production controls, and stocks management. The U.S. had depended heavily on world markets to absorb its excess production and has rarely dumped products in world markets through subsidy programs. It has relied chiefly on accumulating stocks and restricting production in order to maintain minimum prices.

The important point here is not the domestic policies themselves but how they affect world trade and world markets. The EEC policy tends to stabilize domestic markets but to destabilize world markets. This is not its intent but by pushing its supply and demand variability onto world markets and failing to participate in the absorption of shocks from the rest of the world, it leaves world markets thinner, and thus more variable, than they would otherwise be. Also, since trade growth has declined with the world recession in the early 1980's, the EEC's practice of subsidizing exports to dispose of domestic surplus has created serious tension between the U.S. and the EEC.

U.S. agricultural policy also has important implica-

tions for trade. During the 1950's and 1960's, prices were maintained above world prices, stocks were accumulated, and resources were withheld from production. The high U.S. prices and large stocks provided a buffer for world markets and a high degree of price stability. The rapid growth in world demand during the 1970's combined with devaluation of the dollar and lower real support prices brought world and U.S. prices together, and for a number of years world market prices were above support prices and the market ruled. (This was true for major grains, oilseeds, and cotton but not for dairy products, sugar, peanuts, or tobacco, which continued to be supported above world prices and protected from foreign competition.) The false expectation that world demand would continue its rapid growth led government officials to raise price support levels to provide a safety net near prevailing world market levels. The recent decline in world demand growth, combined with a significant increase in the value of the dollar, has again brought world prices below U.S. support prices. The U.S. has lost market share, accumulated huge stocks, and incurred very high program cost. While the U.S. is accumulating stocks and taking land out of production, its support prices in other currencies are high enough to stimulate increased production in other countries.

These are simply examples of the links between domestic farm policy, international trade, and trade policy, the need for consistent farm and trade policies, and the problems that result when there is no coordination. The outlook for growth in supply and demand in the world and the imbalances that are expected within and among countries lead to the potential for renewed growth in world agricultural trade.

No one anticipates a major policy shift such as the one made by the centrally planned countries during the 1970's, so it is unlikely that these countries will contribute to rapid trade expansion as they did in the 1970's. With economic recovery many of the economic and financial constraints placed on agricultural trade during the early 1980's will be relaxed and growth will resume. However, it may take several years for the heavily indebted middle-income countries to relax their severe constraints on foreign exchange. These combined factors lead to the expectation that agricultural trade growth will be slower than during the 1970's until near the end of this decade. The longer-term questions and potential constraints are policy related.

- Will countries become more protectionist or will they be willing to subject themselves to the structural adjustments required to foster competition in world markets over time?
- Will the major trading countries be able to come to agreement on a more equitable and enforceable set of rules to govern international trade?
- Will we be able to strengthen the world financial and

monetary institutions to provide more stability and smoother adjustment to change?

- Will the U.S. and other countries develop more consistent agricultural and trade policies and refrain from attempting to transfer the cost of domestic agricultural programs onto the rest of the world?

What Is the Future Role of the United States in the Global Food System?

The last three decades, especially the 15 years prior to 1982, witnessed rapid growth both in the need and demand for food and agricultural products in many parts of the world and in the available supply of these products. Trade mushroomed and was a major factor in creating a truly global food system with the United States as one of its major components. This global system not only made obvious the interdependence of the agricultural producers and agribusiness people in the many countries but also strengthened the link between agricultural policy and general economic and trade policies. It is no longer possible to make rational agricultural policy without considering general economic conditions and policies and the impact that alternative policies will have on trade.

It is clear that both the need and the demand for food will continue to grow well past the end of this century but probably not as rapidly as they grew during the explosive 1970's. It is also clear that the potential exists to meet the growth in demand. Whether we will meet demand at stable or declining real prices is uncertain, but it is not impossible to meet it if governments are able to structure policies which enhance the free flow of information, technology, capital, and products.

As a major producer and consumer of agricultural products with one of the world's most efficient agricultural production systems and the potential to greatly expand production in the future, the U.S. can continue to be a major force in the global food system. What role the U.S. will play depends largely on the policy choices

we make. If the U.S. chooses to maintain high, rigid price supports as a means of augmenting farm income, protecting inefficient producers, and avoiding structural change, it will likely price itself out of world markets. This will necessitate setting up trade barriers to insulate U.S. producers from the world market. Either programs to restrict production or programs to subsidize the entry of U.S. commodities into world markets will be called for. Under such conditions the U.S. will probably not be a major force in the global food system, or if it is, it will be a destabilizing force rather than a positive force in improving the functioning of global markets.

The alternative is to adopt policies which recognize the global interdependence of the system and which will allow U.S. agriculture to adjust to changing world market conditions. This route will allow U.S. agriculture to participate fully in expanding markets for the commodities in which it has a comparative advantage. In addition, the U.S. will then be a positive force in improving the functioning of world markets. U.S. producers and consumers will be exposed to the variability of world markets but in the long run this may be a small price to pay for a more efficient global food system.

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Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

International Food Policy and the Future of the Farm and Food System

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AMERICAN AGRICULTURE HAS BECOME an international business. The value of U.S. agricultural exports grew from less than \$8 billion dollars annually in the late 1960's to more than \$43 billion in 1981 (Table 1). Exports represent as much as 60 percent or more of the total market for some major commodities (Table 2). Many commodity groups and marketing firms are heavily involved in export sales and in development of foreign markets.

During the last decade food imports have also increased rapidly, from less than \$5 billion annually prior to 1970 to approximately \$15 billion at the current time (Table 1). Increasing amounts of inputs for the farm and food system are now imported as well (Table 3). Thus U.S. and world markets are becoming increasingly integrated in direct consumption imports as well as in exports and imports that affect food industries and farming.

This increased integration has both advantages and disadvantages. On the positive side it has led to unprecedented growth in agricultural production which has increased farm income and employment in the food system. On the negative side, this increased integration means that the markets for U.S. farm prod-

ucts and inputs are subject to political and economic changes around the world over which we have no control. U.S. agriculture is dependent on the foreign buyers, but foreign buyers are also dependent upon U.S. supplies. The instability resulting from this interdependency complicates both production and marketing decisions in the short run and creates a need to adapt domestic farm and food policies to conditions in international markets. For the future, the question posed is how these markets can be developed and stabilized to be consistent with U.S. production capacity and national interest and to avoid the kinds of shocks that arose in the early 1970's.

Table 2 — U.S. Exports as Percent of Production, Major Crops, 1980.

Crop	Unit of measure	Production	Exports	Percent
Wheat	Mil bu	2,374	1,510	64
Rice	Mil Cwt	146	91	63
Corn	Mil bu	6,645	2,355	35
Cotton	Thous bales	10,671	3,639	53
Soybeans . .	Mil bu	1,792	724	40
Tobacco . . .	Mil lbs	1,786	631	35

¹ Preliminary.

Source: *Agricultural Statistics*, 1982, pgs. 4, 20, 31, 65, 105, and 130.

Table 1 — Value and Growth of U.S. Foreign Trade.

Year	Agricultural exports (Mil dollars)	Percent change in exports	Agricultural imports (Mil dollars)	Percent change in imports
1969	6,022	-4 ¹	4,957	-1
1970	7,259	21	5,770	16
1971	7,693	6	5,823	1
1972	9,401	22	6,467	11
1973	17,680	88	8,419	30
1974	21,945	24	10,221	21
1975	21,859	-1	9,293	-9
1976	22,978	5	10,966	18
1977	23,636	3	13,438	23
1978	29,382	24	14,805	10
1979	34,749	18	16,724	13
1980	41,233	19	17,366	4
1981	43,337	5	16,778	-3
1982	36,622	-15	15,366	-8

¹ Based on 1968 exports of 6303 million dollars and imports of 5024 million dollars.

Source: U.S. Foreign Agricultural Trade Statistical Report, Calendar Year 1981, page 1.

Table 3 — U.S. Imports of Agricultural Inputs.

Year	Input imports (\$1000) ¹
1969	409,709
1970	466,106
1971	505,028
1972	632,556
1973	784,552
1974	1,480,113
1975	1,557,970
1976	1,582,460
1977	1,750,450
1978	2,032,960
1979	2,538,720
1980	2,726,560

¹ Includes imports of crude fertilizers, manufactured fertilizers, pesticides, agricultural machines.

Source: *FAO Trade Yearbook*, 1981 and 1975, p. 332 and 497, respectively.

Robert F. Jones, Purdue University, and George E. Rossmiller, Foreign Agriculture Service, USDA, contributed reviews of the paper. This is one of a larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

International policy as well as domestic policy and the link between the two will be crucial to the future development of the American farm and food system. The policy framework is complex. It involves issues related to trade and the rules governing international commerce as well as aid, development of poor countries, food security, and the restructuring of world industrial systems. It is an area where opposing philosophies often collide concerning the role of free markets versus the need for government intervention to establish trade arrangements and develop rules of the game concerning procedures for handling international trade. International policy also clashes with domestic policy and the assumed sovereign right (or political necessity) of most governments to follow policies that reflect solely their domestic interests rather than accepting concessions that improve the functioning of international markets and encourage movement toward improved world economic welfare.

As a leader among nations the United States, along with other industrial countries, bears a special responsibility to develop policies that maintain a functioning trading system and at the same time deal with the problems of poor and disadvantaged countries. This paper will briefly discuss major thrusts in U.S. international agricultural trade policy during the post World War II period and seek to lay out the major policy issues and dimensions that will affect agriculture and the food system from now until the year 2000.

An Historical Perspective

Through much of our history U.S. trade policy has been designed to protect American industry. This position has been justified in numerous ways and through numerous slogans but all of them reflected a posture that argued for the necessity to protect American infant industries from the competition of industrialized Europe in order to promote domestic economic development. With the development of the Reciprocal Trade Agreements Program in the 1930's U.S. policy changed. Under this program the U.S. provided leadership in seeking to reduce trade barriers on a worldwide basis. Until about the mid 1960's efforts were concentrated on industrial trade and industrial policy. Agricultural policy was ambivalent and it resulted in considerable protection of agricultural products as a supplement to domestic price and income support programs.

However, two events during the 1960's brought agriculture into the mainstream of trade policy negotiation and resulted in a U.S. thrust to liberalize world agricultural trade. One of these was the recognition that American agricultural surpluses were not a temporary condition that would be overcome through higher demand resulting from domestic economic growth and prosperity. The second event was the

formulation of the European Economic Community (EEC). While the EEC was a product of U.S. geopolitical interests to provide a West European bulwark against communism, the agricultural community shortly recognized that the EEC's formulation of a common agricultural policy could severely restrict imports of American farm products into what was, and still is, the world's largest agricultural trading area.¹

In order to reduce the conflict between domestic programs and our international trade interests, the United States significantly lowered its high price support levels in the 1960's. This involved the movement to a two price system and has since resulted in the development of a deficiency payments system, with prices maintained through commodity loans at an estimated world price level. Agricultural policy changed from a largely domestic orientation to one of seeking liberalized international trading relationships and the expansion of U.S. agricultural exports.

The first effort to implement this position internationally was made in trade negotiations during the 1960's when the U.S. sought to reduce import barriers in other countries. The second major effort to reduce barriers to agricultural trade occurred in the Multilateral Trade Negotiations (MTN) during the 1970's. By that time Japan had become a major importer of U.S. agricultural products but she still maintained significant import quotas on a number of products. The common agricultural policy in the EEC continued with annually adjusted price levels. In the early 1970's three countries, Britain, Denmark, and Ireland joined the European Community. Britain in particular had been a large food importer with relatively low levels of protection prior to joining the EEC. By this time a number of third world countries were experiencing economic growth and had become significant importers of U.S. agricultural commodities. These countries were included in the multilateral trade negotiations and efforts were made to reduce their import protection. Results were nominal.

During the 1970's two additional factors further influenced policy and emphasized the international trade dimensions of U.S. agriculture. One was the introduction of trading relationships with socialist countries and the recognition that a substantial growing market might exist in East Europe and Russia. This created further instability and difficulty in adapting U.S. domestic agricultural policy to conditions in international markets. The second factor was the recognition that U.S. agricultural exports represented a national asset through their implications for our balance of payments. With these changes of the 1970's, American agricultural policy and trade policy moved from a sectoral focus that dealt with specific commercial interests toward a national focus which had worldwide implications from both an economic perspective and a diplomatic perspective. The U.S., of course, retains a certain amount of ambivalence.

We maintain import protection on such items as dairy products, sugar, beef, peanuts, and certain other minor production items. However, agricultural trade policy will continue to be conditioned by national interests, as well as sectoral interests, and by diplomatic and political concerns as well as economic forces.

Assistance to LDCs

A second major policy dimension affecting the U.S. food and agricultural system is that of fiscal assistance to LDCs. In 1954 Public Law 480 (PL-480) was passed. This law provided the basis for foreign distribution of food and agricultural products through several government programs. It also created the Foreign Agricultural Service of the U.S. Department of Agriculture to promote the export of U.S. farm products.

The U.S. has several objectives in its PL-480 food distribution program. Initially disposal of accumulated U.S. surpluses was the sole objective. Providing relief from hunger and, in some cases, preventing starvation have been ongoing important objectives. More recently the U.S. has emphasized the effect which food distribution can have in stimulating economic development. This reflects a recognition that the long-term welfare of poor countries is highly dependent upon their own internal economic growth and that economic growth, in turn, creates expanded demand for U.S. exports through improved incomes and upgraded diets in countries where development occurs.

During the last decade the scope and dimensions of policy interaction with LDCs has increased. In 1974 a major new dimension was added through the World Food Conference. Industrial countries made a commitment to seek actions that would more effectively deal with hunger and poverty on a worldwide basis. The World Food Council was formed and it remains a significant international institution that seeks to improve nutrition and to eliminate hunger and starvation on a worldwide basis.

During the 1970's the United States, as well as most other industrial countries, established a General System of Preferences (GSP) for industrial exports by developing countries. This program permits non-reciprocal reductions in import barriers by industrial countries. These reductions are designed to stimulate economic development and provide markets for the emerging industries of poor countries. To some extent this program has spilled over into agricultural items and permits tariff free importing of agricultural raw materials. At present, for example, approximately 30 percent of U.S. sugar imports are from countries that have GSP status and thus have a definite price advantage in the U.S. market.

Another method of assisting LDCs was the provision of special and differential treatment in the Multilateral Trade Negotiation. This method provided

special rules in the use of subsidies and other trading procedures for the developing countries. As with the GSP the objective is to provide a trade advantage to poor countries that might not otherwise be able to compete effectively in industrial country markets. This in turn provides these countries with increased export earnings which permits them to purchase more of the industrial and food products and technical assistance which they need for their development.

The Future Challenge

During the post World War II period the United States has been a leader in formulating international institutions and international commercial policy. We established international institutions to serve three ends. The General Agreements on Tariffs and Trade (GATT) was established to define rules of the game in international trading matters and to provide the basis for periodic negotiations to reduce trade barriers. The International Monetary Fund (IMF) was established to handle international monetary relationships and to deal with short term distortions that affected balance of payments. The International Bank for Reconstruction and Development (the World Bank) was established to provide financing and capital flows to poor countries for development purposes.

The international monetary system established through the IMF worked well until the early 1970's. At that time the United States left the gold standard and it has since allowed the value of the dollar in international exchange to fluctuate with market forces. The IMF has lost some of its effectiveness. Similarly the GATT has lost considerable effectiveness. During the multilateral trade negotiations changes were made in the rules and guidelines under which the GATT operates but there is no power of enforcement, and at present some experts question whether the GATT can operate effectively to deal with agricultural trading matters.

While the United States still enjoys a leadership role in international trade and monetary policy, it no longer possesses the dominance which permitted it to virtually impose institutions and policies on the international community. For the future this is the framework within which the United States will need to pursue its economic objectives in regard to food and agriculture and to broader trade and monetary matters. Several questions are at the forefront of that challenge and they will provide the framework within which future policy that affects U.S. food and agricultural systems will be developed. Following is a discussion of these major areas.

Future Agricultural Trade Policy

The United States needs an approach that defines and implements the international aspects of a composite domestic international food and agricultural policy. This is a major task that will require the input of

many groups and involve the most difficult of political processes. Central to this effort will be dealing both domestically and internationally with policies that encourage orderly growth in international markets and generate market stability. During the past decade fluctuating rates of growth in agricultural trade and wide price swings have been the order of the day. This causes producers to face great uncertainty in making production decisions, generates merchandising problems for agricultural industries, and affects consumers, especially those who are poor. Longer term implications flow from the potential effect on investment in agriculture and growth in production, both in industrial countries and poor ones.

Market growth and greater stability would result if significant reductions could be achieved in trade barriers maintained by major importing countries. While progress has been made in reducing some restrictions for agricultural products, others remain at previous levels, and in some cases, protectionism has increased. The major problems continuing to face the United States are those that result from the common agriculture policy in the European Economic Community and the import quotas and other restrictions in Japan. These restrictions are based on domestic protection levels, which in turn reflect the problems of the economic structure in their agricultural systems. Japan, for example, has approximately 6 million farmers who farm approximately 6 million hectares of land. This means that the average farm size is about 2.5 acres. While European farms are somewhat larger, large numbers of very small farms are still in existence. These farms can subsist only with relatively high price supports. The problem thus becomes long term and can be overcome only through economic restructuring of these agricultural systems.

While both Japan and the EEC maintain high prices relative to those in exporting countries, a particularly difficult problem has arisen as a result of the imbalances in production created by the EEC's policies. Major surpluses of dairy products, soft wheat, and poultry have resulted in the use of export subsidies to generate sales of these products in third country markets, which in turn displace sales by the United States and other lower cost exporting countries.

The second dimension to be considered is that agricultural trade policies geared toward assisting development in poor countries will continue to be important. The LDCs are asking that their development interests be considered and that policies be devised to serve this end. They argue that simply reducing trade barriers is not adequate and that other actions to improve their positions in international markets are needed. Whether the LDCs' development can in the long run be best served by policies that increase their foreign exchange, such as preferences and interna-

tional commodity arrangements, is not clear. Nonetheless the U.S. objective of assisting development will continue to be significant in formulating a comprehensive U.S. agricultural trade policy.

Expanding world food production will also continue to be an important element of future U.S. agricultural trade policy. Existing trade constraints in many importing countries inhibit increases in food production in the U.S. as well as in a number of other countries with the potential for greater production, some of them developing countries. Beyond this the question of expanding production in food deficit poor countries contains a set of trade and aid policies of great complexity.

A final point — food and agricultural trade policies need to promote efficient resource use and contribute to the economic well-being of United States agriculture. It is important that these policies assure the continued strength and stability of the U.S. food system. Consumer interests must be protected through a continuing and adequate supply of food from domestic and international sources. Formulating trade policy is obviously very complex, and involves a wide range of instruments and strategies related to reduction in trade barriers, food reserves, food aid, preference arrangements with LDCs and commodity agreements. A strategy which weighs the effect of each policy instrument is required. Abrupt shifts in trade policy that create an undue cost on either consumers or producers should be avoided.

There are alternatives to the U.S. approach to these problems. Central to these alternatives is the philosophical difference between the U.S. approach to trade policy and that which exists in many other parts of the world. This difference is deeply rooted in the economic and political systems of the countries involved and will not be easy to overcome.² Basically it results in the United States continuing to place heavy reliance on the free market while most other countries seek to move in the direction of governmental organization of international markets. This position is strongly held both by the European Economic Community and by many less developed countries. Major impediments to policy formation stem from our inability to evaluate the implications of various policy thrusts. We have little information, for example, on the effective protection levels for agricultural commodities in most countries and hence, are not really in a position to assess the effect of potential changes that might be made. The relationship between various international policies promoted by the developing countries and the achievement of stability in international markets and economic development is not clear. Much of the intellectual and empirical work needed to develop and support a comprehensive policy by the United States has not been done.

Links to Other Domestic Sectors

During the post World War II period great strides have been made in reducing barriers to industrial trade. There is danger of this trend turning around, and, if it does, it will have a major impact on our ability to formulate trade policy for food and agriculture. Because our competitive position in a fairly wide range of industrial products has deteriorated, pressure for industrial protectionism in the U.S. has increased. This movement has led to a strong protectionist position on the part of labor unions — an obvious political force — and to the call for import restrictions by a number of industrial and commodity groups.

An important source of this problem is that American technological leadership is being challenged and there are signs of a decline in our competitive position relative to other industrial countries and some emerging LDCs. A recent cabinet level review listed several reasons for this decline.³

1. The overall sluggishness of the domestic economy in the U.S.
2. The relative cost and availability of capital for new technology in the U.S. as compared with other key nations.
3. The relative degree of research and development efforts between the U.S. and its principal competitors.
4. The ease of global technology transfer.
5. The relative supply of new graduates in the sciences and engineering which has fallen behind that of Japan in particular.
6. The effects of industrial policies in other nations that are targeted on technological development.

If these trends continue, they will have a profound effect on U.S. capacity for leadership in international trade negotiations and they could weaken the process of seeking greater access to foreign markets for U.S. agricultural products. More directly these trends could have a significant effect on agricultural production costs in the United States and on the United States' comparative advantage relative to other agricultural exporters. An increase in the price of steel, for example, has a wide ranging impact on the cost of agricultural machinery and investments required in food processing and input industries. Restricting imports of foreign produced automobiles and trucks, as is currently proposed, would have a similar effect.

In the long run, competitive pressures from foreign producers will affect the rate of modernization in a wide range of industrial areas such as transportation, processing, and farm production, all of which require continued growth in productivity to help maintain U.S. agriculture's comparative advantage in foreign markets.

Link to Macroeconomic Policy

During the past decade the United States economy has been extremely volatile. High inflation in the early 1970's was followed by a severe recession during 1974 and 1975 and this, in turn, was followed by increasing levels of inflation with high employment through about 1980. Since that time inflation rates have declined and unemployment has increased sharply. The period has been characterized by variable but increasing budget deficits (Table 4). Two

Table 4 — Economic Indicators

Year	Growth in real GNP ¹	Consumer price index ²	Unemployment rate- all workers ³	Interest rates ⁴	Gross federal debt ⁵
1969	2.8	109.8	3.5	7.96	367.1
1970	-.2	116.3	4.9	7.91	382.6
1971	3.4	121.3	5.9	5.72	409.5
1972	5.7	125.3	5.6	5.25	437.3
1973	5.8	133.1	4.9	8.03	468.4
1974	-.6	147.7	5.6	10.81	486.2
1975	-1.2	161.2	8.5	7.86	544.1
1976	5.4	170.5	7.7	6.84	631.9
1977	5.5	181.5	7.1	6.83	709.1
1978	5.0	195.4	6.1	9.06	780.4
1979	2.8	217.4	5.8	12.67	833.8
1980	-.4	246.8	7.1	15.27	914.3
1981	1.9	272.4	7.6	18.87	1003.9
1982	-1.8	289.1	9.7	14.86	1147.0

¹ Percent, based on 1972 dollars.

² 1967 = 100

³ Percent of civilian labor force.

⁴ Prime rate charged by banks, percent per annum.

⁵ In billions of dollars on a fiscal year basis. The fiscal year for the Federal Government shifted beginning in fiscal year 1977. Through fiscal year 1976, the fiscal year was on a July 1 - June 30 basis; beginning October 1976, the fiscal year is on an October 1 - September 30 basis. Data from 3 month transition period from July 1, 1976, through September 30, 1976, are included in fiscal year 1977 figures.

Source: *Economic Report to the President*, February 1983, pgs. 165, 221, 199, 240, and 248.

major policy changes during this period have had major effects on the international market position of the U.S. agricultural products: (1) the decision to discontinue support of the value of the dollar on international markets and (2) the decision to move from a monetary policy that stabilized interest rates to one that permitted interest rates to fluctuate while stabilizing the money supply. The effects have been both direct and indirect.

One direct effect has come about through the changing value of the dollar in foreign markets. Following the decision to discontinue support the dollar depreciated rapidly but it has again appreciated during the early 1980's. When fixed exchange rates in international markets were discontinued, capital markets became much more important on a worldwide basis. With the advent of high U.S. interest rates large amounts of foreign funds flowed into the United States. Thus, despite a continuing current account trade deficit, the American dollar appreciated in value. This increased the price of American commodities in foreign markets. While much of this effect is offset by price support programs that exist in other countries and by many LDCs pegging their currency directly to the dollar, these increasing commodity prices have had some effect on the flow of U.S. agricultural exports. In the early 1970's this increased trade, inasmuch as U.S. export prices declined when denominated in foreign currencies, whereas in the later 1970's and early 1980's the effect was to decrease trade.

Another direct effect of high interest rates is that on the costs of agricultural production and storage of agricultural commodities. When short-term interest rates reach high levels, private traders are reluctant to store, even on a seasonal basis, because of the heavy cost involved and this element of market adjustment is lost. High interest rates have placed the risk of storage on farmers, who must hold the grain to avoid low harvest time prices. Interest rates have also affected production costs for farmers, and in particular may have negatively affected U.S. livestock production where a large amount of credit over a longer period of time is required.

The inflation and volatility in interest rates and commodity prices during the 1970's have affected land prices, have created major increases in the prices of farm machinery and other capital inputs, and in turn, have affected the long-term comparative advantage of American agriculture in world trade. Market uncertainty has increased greatly and has affected operations throughout the system. Unless action can be taken to reduce massive future government deficits and to lessen the role that monetary restraint and high interest rates play in controlling inflation, instability in financial markets and foreign exchange markets will continue to create instability in commodity markets, both domestic and international.

Food Power

The question of whether the U.S.'s role as the major world food supplier creates "food power" has two dimensions. One is political, the other economic. The political question arises from diplomats who seek every available advantage in dealing with U.S. international relations. As America's dominance has declined, the search for greater diplomatic leverage has increasingly brought food to the forefront as a tool for dealing with a variety of military, diplomatic, and political phenomena. Historically this tool has been used in our relations with East Europe, Southeast Asia, and in the Middle East. Recently, for example, food was used as an argument seeking increased military expenditure in Japan, the argument being that such expenditures are necessary to assure the availability of imported food supplies. In the late 1970's an international agreement guaranteeing the Republic of China access to limited quantities of U.S. farm products was at the center of establishing improved diplomatic relations. The only justification for that agreement was that it was part of an overall diplomatic package. These uses of food power will continue and they probably represent a positive element in U.S. diplomatic and political relations.

The more general perspective on food power, however, lies in the control of exports for political or economic purposes such as we exerted in our relations with Russia. Establishing an agreement such as the one in the early 1970's following "the great grain robbery" tends to be meaningless. Of necessity, the minimum guarantees provided by each side must be at such levels that in and of themselves they are not effective.

Further, the top limits that are specified are meaningless except to control massive purchases that have a short-term impact on markets. Over the period of a year, any constraints placed on exports by the United States can be made up through purchases from other sources. The same is clearly true of export embargoes such as the one imposed on Russia in 1980 for political purposes. The major short-term effect of that embargo was to create a shock in the market which had to be overcome by direct government action to purchase commodities already in the trade pipeline. Because grain is a fungible commodity (i.e. one in which each unit is interchangeable), and because it will move in response to relatively small price differences, Russian purchases, while temporarily disrupted, apparently were not affected in total. Russia increased purchases from Argentina and other countries, some of whom in turn increased their purchases from the United States. Thus little effect other than market disruption resulted.

The second dimension of food power is that which is promoted by certain agricultural groups. This dimension would involve efforts to raise the price of

U.S. farm exports through controlling supplies moving into foreign markets and thus to directly increase farm income. New institutions would be needed to effectively implement this kind of program. An export monopolist, such as a national marketing board, would be required to manage U.S. export flows. Carrying the institutional question one step further, can the United States provide leadership in developing an international export cartel or in achieving joint supply control action by major exporters? While controlling exports is theoretically possible, such an action would encounter many practical problems and at present this does not appear to be a feasible alternative. One problem, as most recently indicated by the OPEC's problems, is that abiding by cartel agreements is extremely difficult when traders or countries can see an advantage in circumventing them. Secondly, there is no measure of the impact on production that would occur in nonmember countries. Such production could fill the gap left by supply control arrangements among countries that belonged to a cartel.

Government Policy Decision Process⁴

Formulating food and agricultural policy is becoming increasingly complex in both its domestic and international dimensions. This stems in part from the increased number of interest groups that are concerned with food and agricultural policy and in part from the fact that neither domestic nor international policy can be isolated one from the other.

At the international level, a major step forward was achieved in the Reciprocal Trade Agreements Act of the 1930's which moved trade policy formulation from the legislative branch of government to the executive. For a time this change diminished the impact which specific producer groups that would be affected by policy change exerted on trade policy decisions. In recent years this process has tended to reverse. Congressional committees and producer groups lobbying through their congressmen have now gained the power to influence such decisions.

Within the executive branch of government, developing international trade policy is an interagency process. All major agencies participate in developing U.S. national position, both on general issues and on the specific content of agreements and negotiating positions. This means that the interests represented by the Department of State which are political and diplomatic, those of the Department of Treasury which relate to budget matters, those of the Department of Commerce which relate to industrial trade policy, as well as those of the Department of Agriculture and other agencies, are weighed in interagency negotiations before a policy position is developed. In addition, both the Department of Commerce and the Department of Agriculture, which represent clientele groups, maintain systems of producer and industry

advisory committees that influence their positions. All of this adds up to a complicated and politicized decision making process.

Historically U.S. objectives in international trade negotiations have been relatively clear-cut, as has the leadership position of the United States in international commercial matters. Neither of these conditions now applies to the same degree as in the past. For the future there is a definite need to sort out U.S. policy objectives that affect trade within the framework of agricultural trade, industrial trade, and international monetary phenomenon. For example, the U.S. government is faced with immediate pressures to place restrictions on automobile imports and to develop domestic sourcing requirements. Another approach would be for government to provide leadership to reduce the technology gap and restrain cost increases that create the problems in these industries. At present the U.S. government needs to more precisely define issues and articulate objectives in a broad range of international policy matters and, in particular, to relate domestic and international policy actions. Also there apparently is not a clear perception of the extent to which the United States can continue to provide a leadership role and assert its wishes in international negotiations. If we are to continue to be effective in forming policy that serves the national interest of the United States, these shortcomings must be overcome.

Summary and Conclusion

The U.S. farm and food system will continue to be deeply involved in an interdependent world food economy. This means that we must continue to develop policy in an interrelated domestic-international framework. Policy issues that are primarily domestic in focus usually have an international impact, and foreign economic policy for food and agriculture has a domestic impact.

The complexity of the issues that pertain to food and agriculture and their interrelationship with one another, as well as with other aspects of domestic and international policy, places heavy demands on the U.S. policy making process. Furthermore, government agencies represent a broad range of interest groups which have different, and sometimes opposing, criteria concerning policy actions that should be taken. This complicates the policy formulation process.

The participants involved in the policy process at the international level vary greatly in their motivations and in their political and economic structures. The poor countries of the world seek policies that will provide them with an advantage that will improve their rates of economic development. Other countries emphasize the need for market stabilization and the

need for government involvement in international trading to generate "order" in international markets. All countries maintain policies that in some degree isolate their domestic markets from the vagaries of the international market.

In viewing these diverse interests and pressures, the question arises as to what criteria can guide policy formulation. Precise answers that will fit all conditions cannot be formulated. One author suggests that the world food and agricultural system will be satisfactory if it promotes:⁵

1. Reasonable efficiency in resource use so as to support income and development aims and avoid unnecessarily high food costs.
2. Stability in the agricultural and food system to allow sensible, long-term resource use decisions, and the avoidance of disruptions arising from inevitable fluctuations in food availability.
3. Equitable distribution of the costs of both short run adjustments to instability and longer run resource allocation.

These are laudable objectives that reflect efficiency, growth, stability, and equity. At the least, they should be recognized as basic guidelines for future policy formulation.

In the early 1980's the world appears to be at a "watershed" point in international commercial relations. With reduced economic activity and unemployment in many countries and excessive interna-

tional debt burdens in others, pressures to undertake measures to protect domestic industry and employment have increased. It is difficult to predict what set of international arrangements will arise over time. A rush toward protectionism, as has occurred in certain previous eras, is unlikely. On the other hand, achievement of a free international trading system or even a significantly reduced level of government involvement is also unlikely. Between these extremes numerous institutional arrangements and interventions will likely continue. The form that these take will have an incalculable effect on the future of the U.S. farm and food system.

Footnotes

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Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Trade and the U.S. Food and Fiber System

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WHEN INTERNATIONAL TRADE takes place, it benefits the participants on each side of the transaction. Otherwise no trade would occur. In addition to the narrower commercial effects on the individuals, firms, and government agencies involved, some broader economic effects occur as trade develops. These effects are beneficial to an economy at large and can be grouped into two categories—those which stem from specialization in production and those which stem from the exchange of goods.¹

Trade theory indicates that it is to a country's advantage to specialize in producing the goods for which it has a comparative advantage, i.e., a lower per-unit cost than other countries. If currency exchange rates are approximately in balance, comparative differences in production costs determine which goods are exported from a country and which are imported. Trade can profoundly affect the structure of a country's industry and agriculture. Trade will stimulate investment in industries which produce goods that are comparatively cheap and encourage the expansion of these industries. In addition trade will force industries which produce comparatively higher-cost products to contract. As certain industries expand, they will demand inputs and products from other industries. This demand will lead to investment not only in exports but elsewhere in the economy. The benefits of specialization are not limited to expanding export industries.

Resources and investments will move out of the less efficient, higher-cost industries toward the expanding sectors. This process may be easy and rapid or painful and slow. But as it occurs in a market economy, per-unit costs will tend to rise in expanding industries, as less efficient resources are drawn into them, and to fall in declining industries as least efficient resources are forced out. Ultimately the incentive to further expand domestic production for exports will disappear. In time, a country's resources can be utilized fully and most efficiently if they are allocated among industries in order of their comparative advantage. This involves specialization in particular products.

Turning to the demand side, how do individual consumers benefit from the international specialization based on comparative advantage? A trade theorist might say that "international exchange raises the real income of a trading country." This would not convince a steel worker whose job is threatened by foreign steel imports that trade is beneficial. Given the fact that not every consumer will benefit equally from international trade, what are its specific benefits?

International trade is beneficial when it allows buyers access to goods which otherwise would be either unavailable or more expensive. If international trade were interrupted, a large number of tropical products such as coffee, tea, cocoa, bananas, and spices would disappear from the grocery store shelves in the U.S. Domestic production of such items in greenhouses would be extraordinarily costly.

Relatively lower foreign prices also allow U.S. consumers to buy more goods with their disposable incomes. If consumers can buy imported television sets, textiles, or shoes for significantly lower prices than domestic items of comparable quality, they have in effect raised their incomes. Therefore, lower priced foreign goods offer consumers a genuine economic opportunity to increase their purchasing power. This is true regardless of the reason for the lower foreign prices. Moreover, these price benefits extend beyond consumer goods. They are also embedded in imported industrial products and in the raw materials used to produce final goods domestically at lower prices than would otherwise exist. Foreign goods also may be bought because they are less expensive than similar domestic products. At one time the Volkswagen was regarded as less expensive than comparable U.S. cars, although it probably wasn't a lower cost car than the U.S. models. Also, quality may differ and warrant higher prices for foreign products.

Differences between domestic and international price ratios signal a profitable opportunity to sell domestic goods and buy foreign goods. Specializing according to comparative advantage permits a nation to produce

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more of a good than its consumers want and then to trade this good for less costly imported goods from all over the world. This provides a better deal for consumers than if everything were produced at home. In no other sector is this illustrated better than agriculture.

Generally trade is better for a nation's economy than no trade, yet trade may not benefit all individuals in a particular economy. The question of the distribution of the gains from trade is a very complex one which can be further pursued in texts on trade theory.

The issue of U.S. agricultural imports is not treated in this article. Suffice to point out that U.S. agricultural imports are the exports of other temperate-zone industrial country producers and of the third world countries in which the U.S. stake—agricultural and nonagricultural—is high. In the current frenzy over agricultural exports, it is often forgotten that for a long period after World War II U.S. imports of foods and agricultural products were of a similar—and often of a greater—magnitude than its exports of foods and agricultural products. It was not until after 1970, when the great surge of U.S. agricultural exports took place, that the agricultural trade balance became so heavily weighted toward U.S. farmers and policymakers.

The Role of Agricultural Exports in U.S. Development

The importance of agricultural exports to the U.S. economy is not new. Since this country was first settled we have supplied raw materials to Europe, and there have been a few notable examples of primary exports leading regional and national economic growth. Some of the commodities which now dominate America's share of world trade were the engines of growth during the last century. Before the Civil War, cotton accounted for over half of the value of all U.S. exports. Thus imports and the formation of capital in this capital-poor country depended upon the income earned by it. Foreign demand determined the expansion of the Southern cotton economy, which, in turn, stimulated the early growth in producing foodstuffs in the West. European capital, seeking profitable investment in Midwestern development, moved in sympathy with the cyclical surges in the price of cotton.

The role of wheat in the opening and development of the Midwest is another classic case of an export leading regional growth. Facing a highly price-elastic demand in Europe (i.e., a situation in which the amount sold responded disproportionately to price changes), Midwestern wheat exports rose fourfold between 1870 and the early 1890's. This dramatic increase brought the share of exports in the regional gross farm output up from about one-seventh to one-fourth. Farmers' real income climbed 135 percent in only twenty years, with the growth of exports accounting for 30 percent of the in-

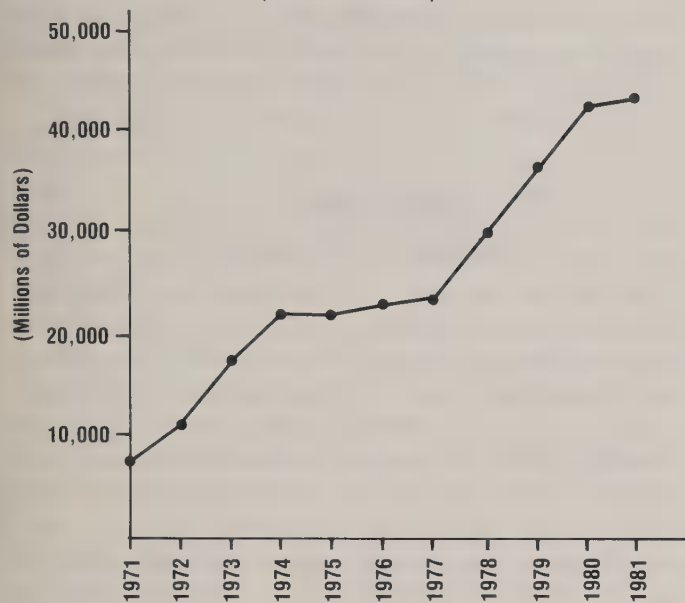
crease.² As it does today, U.S. wheat dominated world grain trade in the last quarter of the nineteenth century. Not only was the U.S. the largest wheat producer, it was also the most efficient producer. Lessons from the wheat boom are instructive for modern farmers and farm economists. This country's competitive advantage seems to have stemmed from its low production costs as well as from the efficiencies of its marketing system—unparalleled economies in long-distance transport, storage, and handling. Such economies still provide the cutting edge for the U.S. share of several commodity markets.

In the last century agriculture provided the livelihoods of far more of America's people than it now does. Decades after Independence we were still for the most part primary producers for the urban, industrial centers of Europe. Obviously there is little resemblance between the cotton economy of the Old South or the wheat economy of the western frontier and the modern U.S. economy. But it is easy to overstress the obvious differences among these economies and thus to miss the continuing similarities in U.S. agriculture. The great wheat boom coincided with the rapid decline in agriculture's share of employment, the first large migration from the farms, and the industrialization which made the U.S. a rival of the most advanced economies on earth. In its reign King Cotton was but a small part of the gross national product, generating only one out of every twenty dollars earned by U.S. citizens. Yet at that time no other activity earned so much foreign exchange and none had so much influence upon the pace of all other activities. The size of agriculture's relative share of total income and employment today *still* belies its enormous importance to the U.S. economy.

The U.S. Share of World Trade Today

In recent times the economies of the world have become very interdependent. During the 1960's and 1970's world trade grew at record rates. Over the past 20 years, the volume of world agricultural exports has increased at a little over 4 percent per year, twice the rate of growth of the volume of world production. The U.S. share of this trade rose from 25 percent in 1970 to 38 percent, or 163 million metric tons, in 1981.³ So long as a discrepancy exists between the growth of world demand and the growth of world supply, high volume producers will have an opportunity to increase their share of the markets abroad. The China market is a case in point. Although Mainland China was the world's second largest producer of cotton three years ago, it was also the world's largest importer, with most of this additional cotton coming from the U.S. The U.S. is in a position to supply the growing world demand for agricultural products because, despite the enormous size of the domestic market, U.S. farmers can efficiently

**Fig. 1—U.S. Agricultural Exports
1971-81.***
(current dollars)



*Data for 1981 are preliminary.

Source: U.S. Foreign Agricultural Trade Statistical Report, Calendar Year 1981. USDA, Economic Research Service, p. 1. Export values are current, free-alongside-ship values at U.S. port of export.

produce far more than domestic demand. Fig. 1 depicts the rise in exports over the past decade.

U.S. farmers might be riding the tide of increasing demand for agricultural goods for some time to come, but perhaps not to the extent which existed in the decade 1972-81. The need for food and fiber is a function of population and economic growth. If the world's population continues to grow at 1.8 percent per year, there will be 5.2 billion people to feed and clothe in 1990. Industrialization in poor countries raises the standards of living for these countries and consequently raises their imports of consumer goods. The first manufacturing industry of many developing countries is textiles, since it involves much semi-skilled labor and few, if any, economies of scale. One after another, the newly industrializing countries have sharply increased their consumption of cotton, thus fueling rates of economic growth that are the fastest in the world. With rising living standards, diets also change. Thirty years ago, red meat was hardly a part of the Japanese diet. By 1980, red meat accounted for one-fifth of the calories that the Japanese consumed. The taste for meat stimulates the production of both grain and beef, since growing one calorie's worth of beef requires more than one calorie's worth of grain.

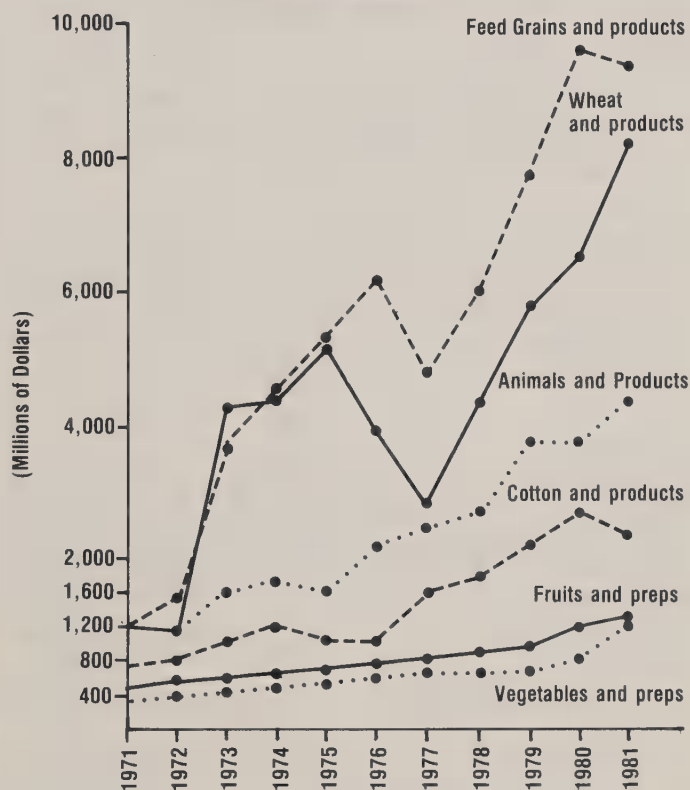
For all these reasons, world agricultural trade has expanded vigorously and since the U.S. is the preeminent exporter in that trade, it stands to gain proportionately.

In 1981 the U.S. Department of Agriculture's (USDA's) International Economics Division projected a 5 to 8 percent annual growth of foreign demand for U.S. farm goods. This would mean that the volume of our agricultural exports would double in the next 9 to 14 years. Prospects now are for somewhat slower growth.

In a world where agricultural trade amounts to 430 million metric tons, the U.S. share of 38 percent represents an immense economic power. We can more easily appreciate this power when we consider the particular commodities that earn the most money for the U.S. In 1980 one of every two bushels of wheat traded in the world was produced in the U.S. Close to two-fifths of the cotton, three-fifths of the coarse grains, and more than four-fifths of the soybeans traded are U.S. grown.⁴ The major traded commodities shown in Fig. 2 do not each, individually, constitute a major share of world trade. But in all of them the U.S. is a large net exporter.

A positive (net export) balance for a given good generally indicates that the exporter enjoys a comparative advantage in producing it. The many compara-

Fig. 2—Selected U.S. Agricultural Exports 1971-81.*
(current dollars)



*Data for 1981 are preliminary.

Source: U.S. Foreign Agricultural Trade Statistical Report, Calendar Year 1981. USDA, Economic Research Service, pp. 2-4.

Export values are current, free-alongside-ship values at U.S. port of export. "Preps" is an abbreviation for preparations.

tive advantages of U.S. agriculture add up to a \$26.5 billion agricultural trade surplus. This surplus is important because in the nonagricultural categories of its merchandise account the U.S. has recently been running a huge deficit. Fig. 3 portrays this deficit and the agricultural surplus in stark contrast. In 1970 U.S. nonagricultural and agricultural balances of trade were roughly equal. Both were surplus by \$1.3 billion and \$1.5 billion respectively. During the 1970's, foreign competition weakened U.S. trade in textiles, steel, automobiles, and petroleum but the strength in U.S. agricultural trade became more pronounced. The extent to which our farm exports can support a sagging non-agricultural trade is limited because they are still only approximately 20 percent of all U.S. exports.

With some of its largest trading partners, the U.S. has now come to rely upon exports of food and raw materials to pay for net imports of manufactured goods. The commodity group in which we have the largest trade surplus with Japan is food, followed by raw materials (excluding minerals, metals, fuels). Together, our exports of these two groups have increased 110 percent since 1973. While our imports of agricultural products from Japan have not increased at all, other imports have increased. During the same period, Japan has increased its trade surplus in manufactures with the U.S. from \$7 billion to \$27 billion, and

in engineering products from \$5 billion to \$25 billion. With the industrial countries generally, the U.S. runs a trade deficit in iron and steel, semi-manufacturers, and motor vehicles. In total manufactures over the past three years imports have exceeded exports by an average \$20 billion annually. On the other hand, net exports of food in the same period have averaged \$13 billion.⁵

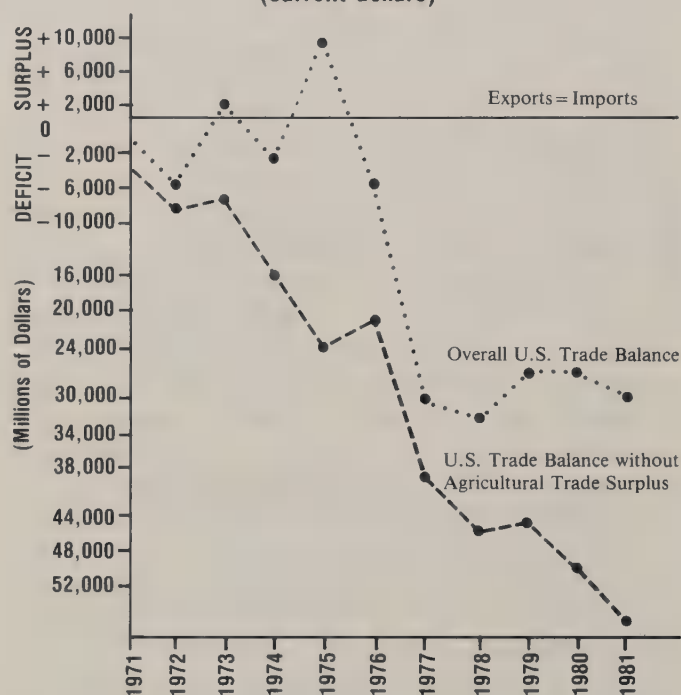
The Traded Share of U.S. Agricultural Production

One way to gauge the relative importance of international trade to the various sectors in our economy is to follow the ratios of their exports to total sales over time, a measure of the extent to which they participate in such trade. In 1961 manufactured exports were 3½ percent of total sales for that sector. Agricultural exports were 15 percent of farm sales. By 1981 the export share of manufactures had risen to a little over 7½ percent while that of farm goods exceeded 30 percent, having doubled only in the previous ten years.⁶ The yield from one out of every three harvested acres in this country is sold abroad.

U.S. farmers need the additional demand that international markets represent. Our agriculture is land-intensive; it is more efficient when high capital costs are spread over more acres. The vast expanses of fertile land in the Midwestern and Western states allow those efficiencies to be achieved. If one-third of acreage were not devoted to exports and farmers were constrained to operate at only two-thirds of capacity, their per-acre costs of production for interest, fertilizer, and other inputs would be higher and their competitiveness with farmers in other countries, and even in U.S. markets, that much less. In 1980, U.S. production of wheat was 300 percent of the wheat consumed domestically. Cotton production was 200 percent of the level consumed at home.⁷ Cattlemen do not regularly send such large surpluses abroad, but they too depend upon the foreign consumers. USDA Foreign Agricultural Service figures show that the export share of hides and skins is currently about 50 percent larger than the domestic share. In 1979 it was 133 percent larger. Foreign demand is capitalized into the land and embedded in the large scale of U.S. farm operations.

Some economists predict that the rising world demand for American farm products will be communicated to American farmers and consumers in the form of real price increases of one to three percent per year during the next decade. This would reverse a 30-year trend of steadily declining real farm prices. This historic reversal would help to buoy the falling profit margins which oppress so many American farmers. If agriculture's low rate of productivity growth does not regain the much higher levels of the early 1970's (and the current high rates of interest all but guarantee that it will

Fig. 3—U.S. Agricultural Exports and an Unfavorable Balance of Trade, 1971-81.
(current dollars)



Source: U.S. Foreign Agricultural Trade Statistical Report, Calendar Year 1981. USDA, Economic Research Service, p. 1.
Balance of trade figures are for calendar years.

not), then only raising the terms of trade for farmers by government action or by other means will relieve them from the cost-price squeeze. Thus would the current importance of trade to our farm population be much enhanced in the decade ahead. Needless to say, economists differ in their opinions about this analysis.

The benefits of robust agricultural trade are not limited to the farm sector. Other industries such as transport and processing have forward and backward links to agriculture that render them beneficiaries as well. The Agricultural Council of America, a trade promotion organization, concluded that in 1980 sales among a set of such linked industries were higher by \$83 billion on account of agricultural exports. The effect of higher farm profits upon federal fiscal policy is difficult to calculate, but the price supports and loans with which the government compensates farmers in distress have added considerably to an oversize budget deficit.

The influence of world demand upon our agricultural economy is not all salutary. Reliance on exports has its dangers. A country that relies heavily upon international trade is particularly sensitive to changes in the economies of other countries. In the 1970's a favorable conjuncture of various economic forces in the world brought about the U.S. agricultural export boom. Now some of those opportune conditions no longer exist and worldwide stagnation confronts U.S. agriculture with serious, albeit short-term, problems. The problem with Mexico, the third largest importer of our agricultural products, is a good example. On the strength of its expected oil revenues and a growth rate of GDP between 7 and 8 percent, Mexico increased its imports of U.S. farm products by 37 percent in 1981. In 1982, for a variety of reasons which included a worldwide petroleum glut, crisis befell the Mexican economy. Under the stringency of new loan requirements and other measures of austerity, Mexico's prospects for future economic growth will have to be lowered. In 1982, Mexico's GDP growth was probably only 3 percent, and in 1983 it should fall further. U.S. farmers stand to lose from this decline.

In trading individual commodities, relying upon volatile demand abroad results in considerable price instability. Cotton has always been heavily traded around the world. Just before the Depression of the 1930's the U.S. exported close to 11 million bales. When the recession set in, cotton prices fell by one-half. Today this vulnerability remains. The very low cotton prices that prevailed at the end of 1980 were probably largely due to the Chinese cancellation of an order for 150,000 bales. Out of a total world supply of 67 million bales that amount seems trifling, but the price of cotton is acutely sensitive to small market changes. In this instance, general anxiety about remaining commitments simply compounded the price effect of a very *inelastic demand* operating upon a *fixed short run supply*.⁹ When

demand is inelastic (remains virtually the same), a small change in supply results in great volatility in producer revenues.

This discussion of the situation and prospects of U.S. agricultural exports would not be complete without examining the trends in what products compose trade and where these products go. In general, the U.S. keeps more of its processed agricultural products at home than it trades. This tendency has become more pronounced in recent years, essentially for two reasons. Compared to the rest of the world the U.S. is most efficient in the growing and handling stages of production. When significant amounts of labor are added to our products, our costs tend to rise relatively higher than the costs in many countries. Second, most governments of the world intervene in markets for processed goods in order to capture added value for their own firms. Major importers restrict the amount of goods shipped in and major exporters subsidize the goods they sell. Freer trade in less processed goods leaves our comparative advantage unimpaired.

Table 1 gives trends in the composition of our farm exports and Foreign Agricultural Service projections for these exports. As the table shows, primary products, including grains, cotton, live animals, fresh fruits, and vegetables, predominate among agricultural exports. Increasing at 20 percent per year over the past decade, these exports constitute the fastest growing, as well as the largest, component of the three export groups. Consequently, their share in our trade has grown since 1972 and ought to continue to grow through 1990. The Far East has traditionally taken a larger share of our products than has any other region. This share is about 35 percent now. The European Community's (EC) purchases have declined in the past five years from nearly one-third of our exports in this group to less than one-fourth of them. The reason is that the EC's farm price supports and export subsidies have created vast commodity surpluses in Europe.

**Table 1—The Composition of U.S. Agricultural Exports
by Value Added.
(Percentage of all agricultural exports)**

<i>Export Group</i>	<i>1972</i>	<i>1981</i>	<i>1990*</i>
Initial (unprocessed)	62.4	67.9	68.5
Value added	37.6	32.1	31.5
First stage (semi-processed)	27.5	21.7	21.8
Second stage (processed)	10.1	10.4	9.7
*Projected			

Source: Foreign Agriculture, *USDA, Foreign Agricultural Service, January 1983, p. 9.*

Semi-processed products constitute two-thirds of our *value added* farm exports. These include cottonseed oil, hides and skins, animal fats, meat, and citrus juices.

Although the EC is still the best regional customer, its share has fallen while the share going to Far Eastern markets has been rising. Japan rivals or surpasses all other countries in its imports of most of America's major initial (unprocessed) and first-stage (semi-processed) exports. Most of this growth has occurred only in the last decade. Even more recent has been the rapid increase of these exports in the other markets of East and Southeast Asia. Korea, Taiwan, Hong Kong, and Singapore are among the fastest growing markets for our animal products, fruits and vegetables, and cotton.

The singular increase in the purchase of these commodities in Oriental markets testifies to a decisive shift in the locus of U.S. trade. USDA Economic Research Service figures reveal that all U.S. agricultural exports to East Asia have been growing at 27 percent per year since 1976. At this rate their value will double in less than three years. The economic foundations of the growth in the Orient are solid. This is no less true if we disregard the preponderant influence of Japan upon average regional statistics. From 1970 through 1981, the average GNP for the countries in the World Bank's East Asia-Pacific Region (excluding Japan) was about 8 percent higher each year. Through roughly the same period, the EC economies grew at only 2 percent per year. West European growth rates of 1 to 2 percent after recovery from the recession which began in 1981 seem to be a reasonable forecast.

Even more striking are the differences in industrial growth. Of the 13 countries whose manufactured output increased at 10 percent or more per year from 1970 to 1978, none were in Europe but five were in the East Asia-Pacific Region. Here population is growing at 2.4 percent and imports of the eight major nations of the region increased from 1970 to 1978 at an annual average rate of 10.4 percent. Everywhere in Western Europe imports were growing more slowly than the *average* for these Oriental nations. The gains to many western states whose lots are cast in the Pacific will be comprehensive and enduring.¹⁰ For example, in the fall of 1982 Governor Bruce Babbitt of Arizona presided at the signing of an agreement between Taiwan and the U.S. for Taiwan to purchase one-tenth of the Arizona cotton crop. If the Atlantic has been "the commercial sea of the twentieth century," the governor observed, then "surely the Pacific Ocean is the commercial sea of the twenty-first."¹¹

Current Issues

The decline of U.S. agricultural exports in the early 1980's has been attributed to a number of factors: a weak world economy, world debt problems, a strong dollar abroad, increased export competition, and an expanded variety of trade restrictions and distortions.

This disappointing performance of U.S. agricultural exports has centered discussion on several policy issues. These issues concern the basic question of how farm exports can be stimulated in a world market characterized by the "negative" factors listed above.

Consumers have sometimes argued against increased farm exports on the basis that exports tend to raise domestic food prices. However, stimulative export policies were pursued in the 1970's on grounds that expanded foreign markets for U.S. farm products provide a long-term cure for the ills of farmers and related businesses while offering significant benefits to the U.S. balance of trade. Expanded farm exports also create nonfarm employment opportunities.

Alternative policy courses for the U.S. to stimulate agricultural exports focus upon three areas—free trade policies, market development policies, and trade agreement policies. It should be noted that the U.S. argument for a free trade policy for agricultural exports has met with only limited success because of failure to persuade other countries to eliminate trade barriers and trade-distorting mechanisms such as export subsidies. Free trade has also been hampered by the world economic recession and by the high domestic agricultural price support policy in the U.S. Market development policies such as efforts toward international trade agreements require the utmost of patience and diplomatic skill. Moreover, abrupt decisions such as embargoes or retaliatory programs toward countries where potential markets exist will only result in a continued lack of stability in world markets for U.S. agricultural products.

Prospects for U.S. Agricultural Trade

The 1970's was a decade of extraordinary growth in U.S. agricultural exports. The 1980's began with a slowing of that growth and this decade could even result in a decline in export volume. Drabenstott¹² has outlined a rather gloomy potential immediate future for our agricultural exports.

Increased protectionism, a sluggish world economy, a slow return of developing countries to financial strength, ample world food supplies, and relative strength in the dollar—all of these factors point to slow growth for farm exports for the next few years. Weaker-than-expected farm exports significantly affect U.S. farms. Without strong export markets, it will be difficult for farm income to return to the high levels of the 1970's in the near future. Grain surpluses will almost certainly continue to pose a major farm problem. Land retirement and other programs such as PIK may be necessary. As a result, farmland values are not likely to post the strong gains they showed in the 1970's.

Large supplies of farm products on the domestic market will most likely mean moderate food prices in

the continuing battle against inflation. Such supplies will also assist in supporting U.S. policies in the developing Third World through programs like PL480.

The slow world recovery will likely hold back growth in world food demand for the next few years. While the U.S. is expected to lead a world recovery in 1983, economic growth of the industrial countries may average only 1.5 percent. Developing countries, which are a primary market for U.S. farm exports, are expected to lag behind the rest of the world in recovery, hence foreign demand for world traded grain will likely remain weak over the next few years.

Given the magnitude of the debt problem and the prospect of a slow world recovery, some developing countries will need several years to work through their debt rescheduling problems. Unless the current reduction in credit available to LDCs is offset by more credit guarantees from the U.S. and other grain exporting nations, world debt problems will continue to limit food demand.

Demand for U.S. farm products continues to be reduced by the strength of the dollar. The response of U.S. agricultural exports to any weakening in the dollar is uncertain. A weaker dollar would not improve U.S. exports to the EC where fluctuations in exchange rates are countered by variable levy tariffs on such major items as wheat and feed grains. Nor would Latin American countries, which effectively peg their currencies to the dollar, be more likely to increase imports from the U.S. On the whole, dollar depreciation would probably provide a boost to foreign demand for U.S. farm products, even though such depreciation alone is not likely to restore strong farm exports.

U.S. trade policy will significantly affect farm exports during the foreseeable future. If the U.S. opts for a policy of freer trade, it may have to critically examine its farm price supports to determine if current supports allow it to compete effectively in world markets. Such a policy also suggests that expanding farm exports in the short-run will depend on a stronger world economy. The arguments which the U.S. presents before the GATT and the actions which it takes toward subsidies and surplus disposal do not convince other countries that the U.S. has considered all possible consequences of its position on "free trade."

Many view trade agreements as offering potential for short-run improvement in agricultural exports. These measures normally are costly and the long-term market gains produced by them are illusory. For example, a new long-term agreement with the Soviets would be a program with the least budget cost, but the political cost might be high. Finally, if nations engage in confrontations such as direct export subsidy measures to compete against one another, short-run market gains might not hold. Markets would be destabilized. On the other

hand, export credit subsidies might result in expanding exports with less danger of encouraging a trade war atmosphere.

Footnotes

¹The following several paragraphs derive principally from James P. Houck and Peter K. Pollack, "Basic Concepts of Trade," in *Speaking of Trade: Its Effect on Agriculture*, Special Report No. 72, University of Minnesota Agricultural Extension Service, November 1978, pp. 21-35.

²Calculated from statistics provided in Jeffrey Williamson, "Greasing the Wheels of Sputtering Export Engines: Midwestern Grains and American Growth," *Exploration in Economic History* 17 (1980):189-217.

³Growth rates of world trade and production appear in *International Trade, 1981-1982* (General Agreement on Tariffs and Trade—GATT, 1982), pp. 2-3; also in "The U.S. Share for 1970-80," in the *Twenty-Sixth Annual Report of the President of the United States on Trade Agreements Program, 1981-82* (U.S. Office of the President), p. 17.

⁴*1982 Handbook of Agricultural Charts, Agriculture Handbook No. 609*, USDA, p. 59; *World Food Trade and U.S. Agriculture, 1960-81* (Iowa State University: World Food Institute, 1982), p. 23.

⁵*International Trade, 1981-82* (General Agreement on Tariffs and Trade, 1982), Appendix 19.

⁶*Economic Report of the President and Annual Report of the Council of Economic Advisors* (U.S. Govt. Printing Office, 1983), pp. 218, 269, 273, 280.

⁷*World Food Trade and U.S. Agriculture, 1960-81*. (Iowa State University: World Food Institute), p. 25.

⁸"Farm Exports to Mexico Advance Sharply," *Arizona Farmer-Ranchman*, June 1982; "The IMF and Latin America," *Economist* 11 (December 1982): 69.

⁹W. W. McPherson and Max R. Langham, "Commercial Agriculture in Historical Perspective," *Amer. Jour. Ag. Econ.* 63 (December 1981): 897.

¹⁰The East Asia-Pacific region includes Fiji, New Guinea, Hong Kong, Indonesia, Korea, Malaysia, the Philippines, Singapore, Thailand, and Taiwan. The last eight have been included in the calculation of average rate of growth of imports, and the weights assigned were equal to each country's share of all regional imports. The raw statistics for this region and for Western European countries appear in *World Development Report, 1980*, (International Bank for Reconstruction and Development), pp. 99, 112-13, 124-25; *World Bank Annual Report, 1981*, (International Bank for Reconstruction and Development), p. 131. The projection of European growth rates appears in "Is There an Export Bull Market Ahead?" *California Farmer*, 4 September 1982, pp. 5, 21.

¹¹"Taiwan Signs Intent to Buy 130,000 Bales of Arizona Cotton," *Arizona Farmer-Ranchman*, November 1982, pp. 35-37.

¹²Mark Drabenstott, "The 1980's: A Turning Point for U.S. Agricultural Exports," *Economic Review*, Federal Reserve Bank of Kansas City, (April 1983): 14, 15. His notes are used extensively here.

III. POLICY INFLUENCES

- **Farm and Food Policy—An Overview**
- **The Future of Farm Price and Income Support Programs**
- **Monetary and Fiscal Policy Connections to Agriculture**

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Farm and Food Policy — An Overview

Ronald D. Knutson

Texas A&M University

WHAT BUSINESS DOES GOVERNMENT have supporting farm prices and incomes?

Why pay farmers to reduce production?

To what degree should the government provide assurance that the family farm will survive?

Under what conditions should we export grain to the Soviet Union?

How can there be surpluses in the United States at the same time that people are starving in the remainder of the world?

Who is to blame for continuously rising food prices?

What role does government play in ensuring that the food supply is safe?

What role should government play in nutrition education?

These issues of farm and food policy have been debated repeatedly over the past century. The list is by no means exhausted. Several of the issues extend back over several decades — even to the early years of the birth and development of our nation. This does not mean that the issues have always been the same. In the early 1970's policymakers were concerned about the adequacy of production to satisfy domestic food needs. Less than a decade later the concern had shifted to surplus production.

The purpose of this article is to provide a broad overview of U.S. farm and food policies. Why do we have them? What are they? Who is affected by them and how? What central policies are of an enduring nature?

Need for Government Policy

Every farm and food policy has its own unique set of proponents, opponents, and problems with which it was designed to deal. An enduring common thread running through all policies and programs is the assurance of an adequate and safe food supply that is distributed equitably at reasonable prices through a reasonably open and competitive market. Such general objectives have broad public appeal. However, they mask much conflict over the direction and form specific policies and programs should take.

Looking at some of the general conditions that bring about government policies in regard to the food system can provide greater insight into the reasons behind these policies. These conditions include:

- The importance of agriculture, food, and related industries.
- The inherent instability of agriculture.
- The relatively disadvantaged position of the farmer and the consumer in the market for food and fiber.

Importance

The overall importance of agriculture, food, and related industries is both overstated and understated. Importance can be measured in nutritional, economic, and political terms.

Food is necessary for life. Wars have been fought, won, and lost over the availability of food. Governments crumble when food supplies become short or prices too high. Mental capacity and health are linked directly to diet. Therefore, it is not surprising that hunger and food safety special interest groups have gained momentum in influencing policies concerning agriculture and food.

Agriculture is also important economically. Agriculture and related input and marketing industries employ about 30 percent of the U.S. labor force. Agricultural exports make a major positive contribution to the U.S. balance of trade, with agricultural exports having exceeded imports by at least \$19 billion over the period 1979 to 1982. In many states agriculture is the single largest industry. For a much larger number of rural communities agriculture is literally the lifeline for economic prosperity and survival.

Having said this, it is essential to note that it is easy to overstate the importance of agriculture as a force in the overall U.S. economy. Considerable dogma surrounds fundamentalist views that agricultural prosperity is the driving force behind the American economy. In 1980, farm population was only 2.7 percent of the total U.S. population. Farm sales were 5.3 percent of the gross national product (GNP), while total receipts for food at retail were only 10 percent of the GNP. Net farm income accounted for

Warren L. Trock, Colorado State University, and B. F. Stanton, Cornell University, contributed reviews of the paper. This is one of a larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

only 1.1 percent of total national income. Food represented about 20 percent of the consumer price index.

The point is that from an economic perspective, agriculture is neither more nor less important than its share of overall economic activity. Agricultural prosperity does not mean general economic prosperity except in rural communities and industries that are directly linked to agriculture. Similarly, general economic prosperity does not mean agricultural prosperity — that fact was evident through much of the 1960's.

Instability

Agricultural prices and incomes are inherently unstable. This instability is largely attributed to the inelastic nature of the supply and demand for agricultural products, and to the fact that farmers are not in a market power position where they can either control prices or automatically pass through increases in costs.

An inelastic demand means that people do not buy much more food when food prices fall. Inelastic supply means that farmers do not ordinarily cut back on production when prices fall. In fact, farmers' continuous adoption of new technology generally results in increases in aggregate food and natural fiber production year after year — barring adverse weather. This, of course, further aggravates the problem of surplus production. During times of stagnant demand and consistently increasing production, it results in the accumulation of even larger commodity stocks, falling prices, and reduced farm income.

The interaction of an inelastic supply and an inelastic demand results in wild farm price gyrations. Short supplies generate very high prices — like those that existed in the early to mid-1970's. During these periods, farmers make money, as do fertilizer dealers and implement manufacturers. Surpluses, on the other hand, mean low prices — businesses related to farming suffer along with the farmers. Instability has another adverse effect — it causes errors in decisions. One year soybean prices are high. The next year farmers plant more soybeans and prices fall — frequently to unprofitable levels. These farmers probably would have been better off planting another crop.

Disadvantaged Market Position

Both farmers and consumers find themselves at a disadvantage when dealing in agricultural markets. Farmers purchase inputs such as chemicals, seeds, and farm equipment from markets which possess considerable market power. Likewise, they produce for markets with unstable prices. Farmers have had an inordinately difficult time organizing cohesively to effectively market their products, manage supplies, and affect prices. Milk cooperatives are among the most

highly organized groups, but even they have found it impossible to control production. Farmers have had more success in operating cooperatives that allow them to purchase inputs such as fertilizer at competitive prices than they have had in organizing to market products.

Consumers are in much the same market position as farmers. That is, they lack market power and are not well-organized. They have had an increasing tendency to question the performance of the food system. Likewise, they increasingly question the safety and nutrition of a food supply whose production, processing, and distribution is based on high technology — chemicals, growth stimulants, additives, colorings, and preservatives. They have even come to question the healthfulness of basic American foods such as milk (butterfat), beef, and eggs because of the potential impact of these foods on cholesterol levels and heart disease.

What are the Policies?

The agricultural and food industries are subject to a wide spectrum of government programs designed to alleviate chronic problems encountered in the production and marketing of agricultural products. These problems could not be readily solved by private initiative and they have become severe enough and widespread enough that government intervened. Most agricultural and food policies and programs are at the federal level, although significant state programs exist in commodities such as milk, fruits, vegetables, and nuts. In fact, state action has often preceded federal initiative.

While agricultural and food policies cover a wide spectrum of concerns, they can be logically categorized into five central groups:

- International trade and development policy
- Domestic farm policy
- Marketing policy
- Food policy
- Resource policy.

While they are far from mutually exclusive, each of these groups will be discussed separately.

International Trade and Development Policy

This discussion of policy opens with the most complex of the five policy groups. Yet beginning with this group seems essential since global events and actions — including the policies of other countries in this ever shrinking modern world — often have more impact on farm policies than do domestic events. The Soviet invasion of Afghanistan provides an excellent illustration. This action precipitated the Russian grain embargo, which may have contributed to reduced foreign demand for U.S. grain and lower importing

country confidence in the United States as a dependable supplier of farm products. Reduced foreign demand, along with higher levels of support for farm prices and income, led to the eventual large accumulation of stocks in the farmer owned grain reserve. The cause and effect relationships associated with the embargo can easily be overemphasized however. Many other factors, such as increased unemployment, a worldwide recession, and high interest rates were contributing factors to reduced exports and the accumulation of surplus stocks in the early 1980's. Yet the central point still stands. World events and policies have had an increasing impact on U.S. agricultural and food policies.

Naturally, international trade and development policies are as much or more a function of foreign policy as of agricultural interests and conditions. While it is not new, food diplomacy has become a powerful and frequently utilized foreign policy tool in the arsenal of the Secretary of State, the U.S. Trade Representative, and the President. Not surprisingly, therefore, the Department of State and the Office of the Trade Representative are deeply involved in determining international agricultural policy, along with the Department of Agriculture.

Trade Policy

Traditionally, U.S. trade policy has been oriented toward opening market opportunities for farm products and facilitating an overall economic environment that encourages trade. Agricultural interests have generally voiced opposition to tariffs and other trade barriers. At the same time, sugar, wool, milk, beef, and tomato producers have maintained programs that protect them from what they consider to be unfair competition.

Opening new markets for farm products has dual components of negotiation to reduce trade barriers and to develop markets. The main forum for negotiating trade barriers has been the GATT — the General Agreement on Tariffs and Trade. Under the GATT, codes of conduct or trading rules have been developed among nations that guide — or are supposed to guide — the trade practices of individual countries. These trading rules are agreed upon in so called "rounds" of negotiation such as the Kennedy Round or the Tokyo Round. Under the GATT, countries that break these trading rules are obligated to compensate countries that are injured.

An important point about GATT is that the trade barriers that were in effect at the time GATT was initially negotiated do not violate the GATT until they are negotiated away. Other exceptions to the initially established rules have been negotiated over time. Thus, the much disputed Common Agricultural Policy (CAP) of the European Economic Community

(EEC), which contains import tariffs and export subsidies, is it not illegal under GATT. Nor are the U.S. dairy import restrictions that existed at the time GATT was negotiated. However, if the United States were to begin restricting the importation of palm oil, it would likely be a violation of GATT.

Negotiation of trade relations is not always accomplished through the GATT. Most bilateral and multilateral trading agreements are established outside of GATT. Long-term trade agreements and international commodity agreements are classic examples of such arrangements.

Long-term trade agreements regulate the conditions of trade between the parties to the agreement. The most frequently covered terms are the annual quantities of commodities to be supplied by one country and purchased by another over a given time period — frequently three to five years. Since the food shortage problem of the early 1970's, long-term trade agreements among nations have become increasingly common. One of the first such agreements for the U.S. involved a Soviet-U.S. commitment to buy and supply, respectively, between 6 and 8 million metric tons of grain per year over a five year period.

International commodity agreements are multinational arrangements to stabilize commodity prices. Commodity agreements generally involve agreements among exporting and importing countries on permissible price ranges, stocking procedures, and in some cases on quantities to be sold in export markets. The United States has been a party to several commodity agreements in the past, most of which have been initiated by third world countries. The inability to control production is the most important problem encountered under international commodity agreements. Even OPEC, a cartel arrangement, has been unable to deal with this problem.

Development Policy

Historically the United States has been a prime supporter of international agricultural development. Development assistance takes the form of helping countries build farm-to-market roads, port facilities, and of developing education and research institutions. It also involves helping farmers in other countries to improve plant varieties, utilize fertilizer, and develop irrigation systems.

U.S. farmers frequently express the view that our government should not help farmers in other countries to grow commodities of which we are a net exporter. For example, peanut producers recently objected to a project designed to help India increase its peanut production. In reality, agricultural development has had a history of leading to overall economic development, which has turned many poor countries into large customers for U.S. farm products. Japan,

Taiwan, and South Korea are classic examples. The initial step in such development efforts has frequently included a combination of helping farmers to grow and market products more efficiently and providing countries with food aid from the United States through P.L. 480 — the so-called Food for Peace Program.

Various individuals also sometimes express the view that we should simply ship our surplus production to the starving people in other parts of the world. Such a suggestion evades the question of who is going to pay the costs of acquiring and shipping the products. In addition, flooding a foreign market with large quantities of surplus grain has the effect of reducing the prices received by farmers in that country. The result is to reduce their incentives to produce. While aid has its place, it must be carefully managed.

Domestic Farm Policy

Domestic farm policy encompasses that portion of farm and food policy that seeks to ensure an adequate food supply, stable prices, and incomes comparable to those of nonfarmers. Historically, domestic farm policy had its roots in adverse economic conditions that surrounded the farm depression of the 1920's and 1930's. Prior to the 1920's, the major government policy thrust was the promotion of settlement, expansion, development, and utilization of the available agricultural land base. An integral part of this pre-depression policy involved setting in place a publicly available agricultural research and education base through the land grant university system. When combined with a profit motivated reward system to both farm input suppliers and farmers, the result of this policy was the continuous infusion of new production and efficiency-increasing technology into the agricultural system.

Domestic farm policy has three major components: price and income policy, stocks policy, and production control policy.

Price and Income Policy

Price and income support has been the driving force behind domestic farm policy. The level of price and income support influences the farmers' level of production which, in turn, affects both stocks policy and production control policy.

The tools of farm and income policy are of two general types — price supports and direct payments. Price supports are accomplished largely through commodity loans made by the USDA to farmers. The loan price (price support level or loan rate) is established as a price per unit of commodity — say \$3.65 per bushel of wheat. The loan is made at or after harvest. If the market price for a product fails to rise

above the loan rate during the year, the government assumes ownership of the commodity and the loan is agreed to be fully paid, including interest and principle. The government's willingness to assume ownership of price supported commodities in full payment of the loan tends to make the loan rate the price floor.

The higher the loan rate, the more likely it is that the government will determine the market price and eventually take ownership of the commodity. High loan rates also significantly affect our competitive position in world markets for farm products. That is, when the U.S. loan rate is above the world market clearing price, stocks accumulate in the United States. In the late 1960's and early 1970's this led to lower price support levels and the use of direct payments to farmers to supplement their incomes. To accomplish the direct payment, a target price is established above the loan rate — say \$4.00 per bushel for wheat. Whenever the average market price falls below the target price, the U.S. government makes a direct payment of the difference to farmers who are participating in the programs. This direct payment is referred to as a deficiency payment. Deficiency payments come directly from the federal treasury.

Direct payments to farmers separate price support from income support. Loan rates can thus be set at a level that allows farmers to compete in the world market while farm income is still protected through the target price. However, the higher the target price and the lower the loan rate, the more potential there is for large government expenditures in times of surplus production. This resulted in estimated farm program costs in excess of \$24 billion in 1983.

The fact is that high target prices have a distinct tendency to cause surplus production which in turn suppresses farm prices. This raises the important issue of the level at which loan rates and target prices are set.

- If the U. S. desires to export a product, it must set loan rates for the product at a level that will not discourage foreign sales.
- Controlling government expenditures without controlling the level of farm production requires that the target price be set at a level that will not generate surplus production at the loan price.

The problem is that such economic rules of thumb are not always politically acceptable. When target prices are set at the average cost of production, the fact that 20 percent of the farmers produce 80 percent of the production means that the majority of the farmers are losing money, and this is not a politically acceptable outcome. Therefore, the incentive is to continuously raise target prices above the average cost of production — a tendency which accelerated in the early 1980's.

Stocks Policy

Stocks or reserves policy involves the willingness of the government to store farm commodities. Storage may be justified as a means of evening out year-to-year changes in production, preventing undue price fluctuation, securing our food supply, and maintaining our integrity as an exporter. Stocks may be held either by the government or by farmers under a price support loan.

In the United States, government stocks may be accumulated either through direct purchase or through government takeover of commodities under the price support (loan) program as discussed above. High government stocks are usually a consequence of surplus production of grains.

Stocks may be held by the farmer under either a nine month price support loan (the same loan discussed under price and income support policy) or under a three year loan referred to as the farmer owned grain reserve. Stocks under a nine month price support loan are generally considered to be working stocks, in the sense that most of them will find their way into regular commercial market channels as the loans are paid off — assuming loan rates are not set above world market clearing prices. Farmer owned grain reserve stocks are not available to the market unless the market price rises above a “trigger” or release level. If the market price never reaches the release trigger in the three year life of the loan, the commodity becomes the property of USDA — part of government stocks.

While stocks policy can play an important role in preventing food shortages, high levels of stocks are costly to maintain. In addition high stocks suppress farm prices. An optimal level of stocks thus becomes one that is sufficient to protect against shortages yet allows prices to rise above loan levels, particularly after the normal harvest glut.

Production Control Policy

Excess production capacity has been an integral part of the farm problem since at least the 1920's. Except during World War II and the Korean War, overproduction was a chronic problem from the mid-1920's through the late 1960's. This excess capacity was largely a result of rapid expansion of investment in agricultural technology. Once in agricultural production, resources were slow to move out of production. Government policy contributed to overproduction. Relatively high price supports encouraged increased production while they made U.S. farm products unattractive to potential importing countries. While government support for agricultural research and education increased production efficiency and reduced food costs, it also increased output thus contributing to surpluses.

This combination of conditions led to numerous government initiatives to control farm production. Initially, many of these initiatives were undertaken on an individual commodity basis. By the 1950's government policymakers realized that this simply pushed the surplus problem around from one commodity to another. As a result they adopted production control efforts that cut across commodities. These efforts take two major forms:

- **Mandatory programs** where producers are given either the right to produce on only a certain number of acres of land (allotments) or the right to market only a certain quantity of product (quotas).
- **Voluntary programs** where producers are paid to take land out of production. Payments may be in the form of cash or commodities (payment in kind) which are part of government stocks. Reduced production is normally required for farmers to receive program benefits such as participating in the loan program and receiving income payments.

The merits of government programs designed to control production have been the subject of considerable debate since at least the 1930's. Advocates of control point to the inherent instability of agriculture, the existence of excess production capacity, and the trend toward fewer farmers. Opponents of control point out that surpluses result because price and income supports are too high. Production controls, they argue, reduce farm exports, raise production costs, benefit only those who are initially given the right to produce, and raise food prices.

Marketing Policy

Often overlooked as a component of farm and food policies is a host of government programs designed to make markets perform in a more orderly and competitive manner. These programs result largely from the disadvantaged market position of farmers and consumers. Many of them have been the subject of recent challenges by interest groups within and outside agriculture. Included are market information, grades and standards, marketing orders, cooperatives (including bargaining), and antitrust policy.

Market Information

It is generally agreed that the United States has the most complete and accurate market information system in the world. U.S. data on production, trade, and prices are utilized by farmers, marketing firms, and governments as a basis for both private and public decisions.

Complete, accurate, and timely market information puts all market participants more nearly on the same competitive basis. Improved production and market-

ing decisions result. There should, therefore, be unanimous support for information policies and programs. Wrong — information is power. Those who thirst for market power would often like to see the government out of the information business. Those who believe in another role for government often also believe that information should be a private good provided by private firms. If this were done, much information would only be available to those farmers, marketing firms, and consumers who could afford it. The balance of market power would shift even further in the direction of the larger farmers and marketing firms.

Grades and Standards

Agricultural products are not homogeneous. Differences in product quality affect the ultimate use of these products and, in turn, their value. Buyers of products such as lettuce or cheese are frequently far removed from the seller. They want assurance that they are receiving the quality of product that they are paying for, while sellers want assurance that they are being rewarded for producing a quality product.

To satisfy these demands, a system of grades and standards has been established for most farm products. The standards define the criteria determining each grade. For example, U.S. choice beef must have a certain minimum ratio of fat (marbling) to lean in the muscle. The use of grades is generally voluntary. Some contend it should be mandatory. Consumer interests also frequently suggest that the standards for grades ought to be more consumer or end-use oriented. The combination of consumer-oriented mandatory grades would make comparison of product quality easier. It would also make it more difficult for food processors and retailers to differentiate their products through brand advertising. The food industry has, therefore, generally opposed both consumer-oriented grading and mandatory grading.

Marketing Orders

Marketing orders regulate the conditions under which specific farm products are marketed. They are prevalent in milk, fruits, and vegetables. Milk marketing orders set the price that processors must pay for milk in designated areas of the United States. Higher prices are set for milk used for fluid consumption than for milk used to make butter and cheese. Fruit and vegetable market orders may regulate the volume of product marketed, the quality of product marketed, or the flow of product into market channels over time.

The main objective of marketing orders is to create orderly marketing conditions. For example, without milk marketing orders in the 1930's milk prices fell far below the cost of production. In the case of fruits and

vegetables, products unfit for human consumption sometimes entered the market channels. Opposition to marketing orders stems from two main sources — those who contend that orders raise prices to consumers and those who contend that the conditions that justified orders in the 1930's no longer exist. Whether the conditions that fostered orders in the 1930's still exist or the extent to which marketing orders raise prices are open to debate. Producer cooperatives are undoubtedly larger and stronger today than they were in the 1930's. The central issue is whether they are sufficiently strong to maintain orderly marketing conditions.

Cooperatives and Bargaining

Cooperative and bargaining policy is designed to redress the imbalance of market power that exists between farmers and the marketing firms which buy farm products. This is done by giving producers the right to organize cooperatives and, to a more limited extent, bargain with marketing firms.

The right to organize cooperatives involves an exemption from certain aspects of the antitrust laws. That is, farmers are allowed to organize or merge cooperatives but cannot in the process exercise coercion or predatory practices against either other producers or processors. The right to organize or merge may even encompass 100 percent control of the market but that right cannot include firms that are not organized as producer cooperatives.

The right of producers to bargain with marketing firms is considerably more limited. While the right to organize for bargaining over price and other terms of trade is clear, marketing firms generally have no obligation to bargain. An important exception exists in Michigan where the state has created an obligation for marketing firms to bargain in good faith with designated producer bargaining agencies. The need for producer bargaining power is most apparent in instances where the producer has a contract with processors to grow perishable products such as tomatoes. Processors, of course, strongly resist the enactment of effective bargaining legislation.

Antitrust Policy

The basic purpose of antitrust policy is to create competitive market conditions by preventing monopoly conditions and anticompetitive firm behavior. Except for the cooperative and bargaining exemptions, the same antitrust laws apply to agricultural and food marketing firms as apply to American industry in general.

Despite the antitrust laws, several agricultural and food marketing firms have substantial market power. Included are firms that manufacture farm inputs, market and/or process farm products, and food retail-

ers. Such concentrations of market power are by no means limited to agriculture. They form, in fact, an image of the American economy.

Antitrust concerns exist, however, that are relatively unique to agriculture. The Packers and Stockyards Act was enacted into law in the early 1900's to maintain competition in livestock market and meat packing. Some suggest that since markets and industry structures have changed, this agency has outlived its usefulness. The Commodity Futures Trading Commission (CFTC) was set up as an agency independent of the USDA to prevent monopolistic abuses in the futures market for farm commodities as well as for other nonfarm commodities and financial instruments.

One concern that is receiving increasing attention is an apparent trend toward vertical integration in agriculture. Vertical integration exists when a firm controls more than one level of the production-marketing system for a product. Broilers, turkeys, and eggs are generally produced in a vertically integrated system. That is, major broiler marketing firms also control production. To a lesser extent, some of them even operate their own fast-food outlets.

The public policy concern is that vertical integration converts traditional family farm agriculture into corporate integrated agriculture. This concern is just one dimension of a broader farm and food policy issue generally referred to as the structure of agriculture. The central issues involve who will control the resources, production and marketing of farm products, whether the family farm will survive, and whether the government should do anything to see that it does. These issues are obviously broader than just antitrust policy. In fact, it is generally agreed that current antitrust laws do little to discourage vertical integration. They could, however, discourage integration or even prevent it, if that were the will of the American people.

Food Policy

Food policy deals with those issues that directly affect consumers — food prices, food assistance programs, food safety, and nutrition. While consumers have always been concerned about the potential for price gouging and the maintenance of a sanitary food supply, a broader set of consumer issues has taken on greatly increased visibility since the 1970's. Although consumers are still more fragmented organizationally than farmers, they are becoming more formally organized to influence agricultural and food policy.

Food Price Policy

Contemporary concerns about food prices originated as a result of the consumer meat boycotts of the early 1970's and of the rise in food prices that oc-

curred throughout the decade. The government responded to the boycotts and rising prices by placing controls on prices, imposing embargoes on exports of soybeans and wheat, and importing dairy products. Farmers, food processors, and retailers were irate! Marketing of beef was delayed during the price freeze, shortages arose, and a glut occurred after the price freeze was lifted. The farmers' reaction was swift, as is characteristic of members in competitive industries with relatively low profit margins. Government policymakers did not expect this reaction as they were used to dealing with large firms having considerable market power.

Food Assistance Policy

Food assistance programs originated in efforts to dispose of surplus farm commodities, help the poor, and curb hunger and malnutrition. While they initially emphasized direct distribution of surplus commodities to poor families and distribution through school lunch programs, the program emphasis shifted to food stamp allowances based largely on income and the cost of food in the 1960's. By the 1980's over 20 million individuals were recipients of food stamps and program costs exceeded \$10 billion. Controversy is evident over the cost of the program, duplication with other welfare programs, whether food stamp recipients should be required to work, and whether commodities rather than stamps ought to be distributed.

It is interesting to note that late in 1981 the USDA began distributing commodities in addition to stamps — reemphasizing the surplus disposal aspect of food assistance programs. The USDA, however, no longer had the direct distribution system that had been dismantled with the advent of the food stamp program. A food assistance program having a particularly good record is the Women, Infants, and Children's (WIC) program, which combines direct commodity distribution with nutrition education targeted specifically toward needy expectant mothers and needy mothers with small children. However, even this program is not without controversy, as conservatives charge that the program fosters single parenthood and illegitimate children.

Food Safety Policy

The U.S. food system has a particularly good record in avoiding incidences of food borne diseases. This is due in part to the extensive regulation of sanitation conditions under which food is produced, processed, and distributed. However, advanced food production techniques and high levels of food processing have resulted in the use and presence of many additives as well as chemical residues in the food supply. The use of antibiotics, growth stimulants, pesticides, herbicides, preservatives, and food color-

ings has brought on increasing regulation by the Food and Drug Administration, the Environmental Protection Agency, and the USDA. Much controversy remains, however, as consumers almost inherently mistrust an increasingly complex food industry.

Nutrition Policy

What role should the government have in influencing what people eat? Until the 1970's nutrition education was left largely to the schools and the dieticians. The good nutrition message was basically one of variety — eat some of the four basic food groups (meat, milk, fruits and vegetables, and bread) each day. But increased attention to diet and health caused us to become more aware of the problem of obesity. In addition, medical research suggested an increasing number of links between poor diet (snack foods, alcohol, sugar, and salt) and health (high blood pressure, heart disease, cancer, and birth defects). While the evidence was not conclusive, it was sufficient to cause concern and to create a policy change.

The basic nutrition policy change was federal encouragement of a different nutrition message. The new message was one of moderation — it said eat less and avoid the newly composed fifth food group composed of sugar, fat, and alcohol. The farm lobby was enraged! Its members felt that government should encourage food consumption — not discourage it. They also felt that under no circumstances should government single out certain industries — dairy, eggs, beef, and sugar — for reduced consumption. The USDA's role in nutrition education came directly into question and to this day it remains unsolved.

Resource Policy

For decades it was assumed that the United States would always have enough food. Excess agricultural productive capacity was the problem, not the potential for shortages. Crop failures of the early 1970's, the activities of OPEC, and reduced water supplies in the West and Southwest led to the realization that resources for food production were by no means unlimited. The organization of farm worker unions convinced people that agriculture was not immune from strikes.

Policies to deal with agricultural resource issues are in their infancy. Traditionally agriculture's position has been that it is unique and should, therefore, be exempt from regulation. Thus, farm labor is not covered by the National Labor Relations Act. Ground water use has gone largely unregulated. Water from

federal irrigation projects has been provided to farmers at a fraction of its cost. Farm land has come to be taxed on the basis of its use value rather than its market value. Soil conservation has been voluntary with specific practices frequently being subsidized by the government.

The seeds of change in resource policy have been sown. Most of the initiatives to date have been at the state level. California has its own labor organization law. Several states have begun to license wells for irrigation. Agitation for increased federal recovery of irrigation costs is apparent. Laws requiring certain soil conserving practices are appearing on the books. Some people are even beginning to question whether farmers might have too many tax breaks. In the decades ahead, resource policy will undoubtedly play a more important role in influencing farming practices and the prices we pay for our food.

The Enduring Issues

Agriculture and food policy evolves slowly. While watershed changes are frequently predicted, they seldom occur. Government is generally slow to act and that is probably good. By the time government finally get around to seriously considering a problem, it has frequently changed in its nature or gone away. However, some issues of an enduring nature have been identified. These are the issues that will continue to be the focal point of food and agricultural policy. While these issues cannot be identified with absolute certainty, they include several questions.

- To what extent are the United States and other nations going to pursue a policy that depends on trade to satisfy world food needs?
- To what extent is the market going to be relied upon to determine farm prices and incomes?
- What steps should be taken, if any, to ensure family farm survival?
- How will government provide assurance that individuals have sufficient food to eat — through cash, food stamps, or commodities?
- To what extent should government be involved in determining the allocation and use of resources in agriculture?

It is not our role to suggest which policies are the most desirable or how these issues should be resolved. It is the responsibility of every individual in a democratic society to make that determination for himself and to make that view known to the policymakers.

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

The Future of Farm Price and Income-Support Programs

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AMERICAN FARMERS have experienced periodic financial difficulties for many years. Frequently the market—not the actions of individual producers—has been the source of these difficulties. As a result, attaining adequate farm prices and incomes and maintaining them has become an important public policy issue.

The purpose of this paper is to briefly review the need for price and income support programs, to characterize and evaluate the federal government's response to this need, and to outline the issues likely to affect future programs. The primary focus will be on "commodity programs," although selected broader policy options will be briefly analyzed.

Nature of the Problem

Understanding economic problems in American agriculture is not an easy task. For one thing, observers frequently confuse the symptoms of these problems with their causes. The result of such confusion is policies which do not alleviate "problems." Another difficulty is that economic problems vary over time, by size of operation, by enterprise combination, and among regions. No single solution will solve all problems.

Despite these difficulties, government assistance for farmers is best understood through two characteristics of production agriculture: 1) a chronic excess capacity for production which results in both low farm incomes and low cash returns to capital committed to farming; and 2) instability of production, prices, and income.

Excess Capacity—The average disposable income per capita of the farm population has consistently lagged behind that earned by the nonfarm population. The only exceptions in the past 50 years were in 1973 and 1979. However, the ratio of farm to nonfarm incomes has improved over the years. In the 1930's, the average income of farm families averaged less than 40 percent of nonfarm families. It rose above 50 percent in the 1950's, reaching 70 percent for the first time in 1966, and 80 percent in 1972. Between 1973 and 1981 the ratio of farm to nonfarm incomes varied between 77 and 104 percent.

Part of the improvement is the result of farm families

earning more of their income from off-farm sources. In fact, off-farm income grew from 40 percent of total farm family income in 1960 to 60 percent in the early 1980's.

Farm incomes represent a return on unpaid labor, management, and equity in land and equipment. But another way to analyze the financial well-being of farmers is to consider the return to individual resources. Since 1960, for example, current earnings on farm equity capital have averaged about 4 percent per year. However, when current earnings and capital gains on equity capital are combined, the overall rate of return on capital more than doubles. These total returns on farm equity capital compare favorably to similarly combined returns on common stocks and on government and corporate bonds during the 1960-1981 period.

Instability—Farmers are frequently confronted by instability in production, prices, and income. This instability is caused by a number of factors including general economic conditions, weather, political decisions, and plant and animal diseases. Moreover the quantity of farm products demanded is only slightly influenced by prices. This adds to instability problems, as does the highly competitive structure of farming, which denies individual farmers an opportunity to "balance" supply with demand.

In the recent ten years between 1973 and 1982, aggregate net farm income in the United States varied from \$18 to 33 billion in current dollar terms. In constant dollars, the variation was even more extreme. After reaching \$25 billion in 1973 (1967 dollars), real income declined four straight years to \$10 billion in 1977. After regaining some lost ground in 1978-79, incomes slumped severely to even lower levels in 1980-82. Overall, the variability in farm income was over three times as great in the 1970's as in 1955-63.

Unstable income continues to concern particular segments of agriculture (e.g., crops, livestock) and individual farmers. A recurring problem is that too many resources are coaxed into agricultural production during high-price periods. However, these same resources—land, labor, and capital—are often so immobile that they cannot exit from agriculture when prices turn

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lower. Thus current returns to resources can be low for long periods of time. Table 1 indicates the variability of farm income over the past two decades, its recent decline associated with excess capacity, and farmers' increasing reliance on off-farm income.

Table 1—Net Farm Income, 1961-1982.

Year	Net farm operator family income from farming, per farm		Farm operator family income from off-farm, per farm
	Current dollars	Constant 1967 dollars	Constant 1967 dollars
1961-1965 Avg.	\$ 3,313	\$3,604	\$3,327
1966-1970 Avg.	4,369	4,139	4,796
1971-1975 Avg.	9,798	6,357	6,128
1976-1980 Avg.	9,922	4,935	6,266
1981	12,349	4,533	6,014
1982	9,188	3,178	5,683

Source: United States Department of Agriculture.

Evolution of Policies and Programs

Over the years the U.S. government has introduced a number of programs designed to directly address the problems of low returns to resources, price instability, and income in agriculture. Commodity programs have included such instruments as nonrecourse loans, production controls, direct payments to farmers, and market orders. Domestic food distribution programs have been developed to increase the demand for agricultural products and to provide an adequate and nutritious food supply for low income and dependent citizens. Other programs have been created for the international market to stimulate demand through exports and to restrict competitive imports. In the discussion that follows, the policies and instruments in each of these problem areas are briefly reviewed and evaluated.

Commodity Programs

The review that follows is too brief to include a thorough discussion of each of the commodities, the particular problems encountered by its producers, and the government's response to these problems. However, several points are worth noting.

First, the producers of some commodities have received relatively little assistance from public funds. Producers of cattle, hogs, poultry, and soybeans are notable examples. In contrast, producers of such crops as wheat, tobacco, peanuts, and cotton have been consistent users of commodity programs.

Second, the major techniques or instruments used in programs have varied according to commodity. These techniques can be summarized as follows:

1) Supply controls and price supports: wheat, corn and other feed grains, cotton, rice, peanuts, and tobacco.

2) Price assistance without supply controls: manufactured dairy products and wool.

3) Price assistance primarily through limiting imports: sugar and beef.

4) Price assistance through marketing orders: dairy products, certain fruits, and some vegetables.

The economic and political basis for commodity programs dates back to the 1920's. That decade, while generally favorable for the nonfarm sector, was a period of economic crisis for American agriculture. Farm prices and incomes plummeted from the levels they had reached only a few years previously. The first efforts at relief brought forth a series of legislative proposals known as McNary-Haugen Bills, none of which were adopted. However, that decade did produce the first federal program to improve farm prices and incomes in the form of the Agricultural Marketing Act of 1929, which established the Federal Farm Board and the idea of parity.

Of all the concepts that subsequently became a part of commodity programs, the notion of parity or a "fair price" was the most lasting. The image of parity became associated with higher, more stable, farm incomes. Over the last decade, however, policy deliberations about farm income have increasingly emphasized costs and volume produced. As a result, policymakers have moved away from parity. In its place, they have sought prices which will at least cover production costs.

Price supports have been the federal government's primary instrument for stabilizing or raising prices during the past half century. Typically, such supports have been implemented through nonrecourse loans to farmers. These loans may be redeemed either by a cash payment or by turning the commodity used as collateral over to the government.

While nonrecourse loans were first set as a percentage of parity, they are now set nearer to world market price levels. If price supports are set above market prices, farmers accept the loans as their prices for particular commodities, and the government accumulates stocks.

The farmer-owned reserve (FOR) is another policy instrument used to stabilize commodity prices and at the same time to help meet the nation's longer-term domestic and export needs. A product of the Food and Agriculture Act of 1977, this measure stipulates that feed grains and wheat be held under nonrecourse loans for longer periods of time (3-5 years) than under regular nonrecourse loans. If prices rise sufficiently while grain is in the FOR, farmers can take advantage of those higher prices by paying off the loans in cash. The FOR both absorbed grains from the market and released grains to it until early 1983. By that time substantial stocks had been accumulated, in part because the FOR was being used as the primary price support mechanism. USDA policymakers then chose to deliberately reduce reserve holding through the payment-in-kind (PIK) program.

Supply control programs have been used frequently

since the 1930's, with the intent of bringing supplies into balance with demand at the price support level. In a sense, individual producers have had to view these programs as the price paid for government benefits. However, production control techniques have varied as has their effectiveness.

The predominant technique used until the early 1960's was compulsory production control, involving acreage allotments and marketing quotas applied to each producer on an historical basis. With overproduction and accumulated stocks plaguing farmers due to the ineffectiveness of this approach, the government redirected this policy with the emergency Feed Grain Act of 1961. A voluntary production control program was launched, which provided incentives to persuade producers to participate in land diversion programs. Following the gradual expansion of this voluntary approach to most program crops during the 1960's, it was refined to provide more operating freedom for farmers through more current crop bases and yields and through "set-aside" percentages for individual crops, with remaining acres to be planted to any crop.

The increased flexibility in planting coincided with the great growth in export demand during 1970's. In years like 1973 and 1974 when production increases were not as great as demand increases, many policy analysts talked openly about ending acreage adjustment programs. Indeed, the decade of the 1970's saw little use of such programs, although the Agriculture and Consumer Protection Act of 1973 and the Food and Agriculture Act of 1977 updated the legislative authority for voluntary acreage adjustments.

The Agriculture and Food Act of 1981 did not change the voluntary approach to production control, but it did grant more discretionary authority to the Secretary of Agriculture than did previous legislation. Because of record production in 1981 and 1982 and reduced demand, especially in the export sector, the Secretary has used that authority. In 1983, the benefits package of regular and reserve loans, deficiency payments, diversion payments, and payments-in-kind persuaded producers to retire a record amount of land from production.

Direct payments for land retirement became an important policy instrument in the Agricultural Act of 1956, although such schemes had been used intermittently since 1933. Under the 1956 Act, farmers were paid for retiring land and committing it to a Soil Bank.

In 1973, the Agriculture and Consumer Protection Act provided for supplementing market prices with deficiency payments whenever the former fell below predetermined target prices. These target prices were linked to annual production costs in both the 1973 and 1977 Acts, but in the 1981 Act they were predetermined for the 1982-1985 period. In 1983, the latest version of direct payments was the payment-in-kind program.

Farmers received a specified amount of grain as payment for taking land out of production. This grain could be converted into dollars on the open market or fed to livestock.

Market segmentation has been proposed since the 1920's. The idea behind segmentation is to sell in two or more markets at different prices. The technique involved is one of price discrimination in which a commodity is sold at a higher price in the primary market than in the secondary market. For example, wheat that is milled into flour might be sold at a higher price than wheat that is exported or fed to livestock. A well-segmented market will provide higher returns to producers than a market in which all of a commodity is sold at a single price. However, the problem has always been to keep markets divided into high and low price segments and to avoid retaliation from other producers or trading nations.

The most notable successes with two-price plans have been in the dairy industry and in the sale of fruits and vegetables. For milk production, markets are separated into fluid milk and processed products, usually using a Federal Marketing Order. Fruits and vegetables are segregated between fresh and frozen or canned markets, again sometimes using an Order or Federal Marketing Agreement. Producer approval through referenda is usually required.

Though there has been no formal use of such a plan for grains and cotton, export subsidies during the 1960's and early 1970's provided many of the effects of a two-price plan. The blended export credit plan (the use of interest subsidies) of the 1980's also has some of the trappings of a two-price system.

Domestic Market Expansion Programs

Food distribution programs were initiated by the Department of Agriculture in 1933. The first program supplied surplus food products, including meat, butter, cheese, and flour to unemployed workers and their families. In August 1935 an amendment to the Agricultural Adjustment Act of 1933, known as Section 32, set aside 30 percent of customs receipts to be used to encourage the exportation and domestic consumption of agricultural commodities. Direct distribution of food to schools, institutions, and needy persons continues today.

The school lunch program is another product of the 1930's which has helped to expand the market for agricultural commodities. The federal government and individual states have shared responsibility for the program.

The food stamp program was initially launched just prior to World War II, then revived by Presidential Executive Order in 1961, and finally enacted as the Food Stamp Act of 1964. Unlike some previous food distribution programs, the primary purpose of food stamps has

been to improve the nutrition of underprivileged persons.

The food stamp program has become the largest assistance program ever instituted in the United States. In 1982 more than 20 million people received program benefits. However, program cost, now over \$11 billion annually, appears at least temporarily to have become a barrier to further expansion.

The Child Nutrition Act of 1966 emphasized providing nutritious meals to children. Special milk, school breakfasts, summer food services, and child care food programs have all resulted from this law. In addition, the women, infants and children (WIC) program provides nutritious foods to pregnant, postpartum, and breastfeeding women who have inadequate incomes. The WIC program has grown rapidly, with outlays rising from \$422 million in the 1978 calendar year to an estimated \$1 billion in 1982.

In fiscal 1982, food and nutrition assistance programs accounted for \$15.5 billion of the USDA's budget. Food stamps accounted for about 75 percent of the total with the remainder scattered across other program areas. By comparison, federal outlays on food programs totaled \$789 million in FY 1965 and \$6.8 billion in FY 1975.

The economic effects of food and nutrition programs and agriculture have been positive, although they cannot be easily quantified. The federal outlay on food programs has averaged about 4-5 percent of total consumer food expenditures in recent years. One mid-1970's study showed that half of that expenditure would not have occurred without government assistance. Another study showed that government assistance increased expenditures for high-value food products such as meats, fruits, and vegetables. To the extent that food purchases have increased as the result of these programs, farm prices and incomes have increased.

Trade Issues and Policies

In recent years agricultural exports have accounted for the production from 30 percent or more of U.S. cropland acres. The United States is one of the few countries in the world where most trade is the responsibility of the private sector. Still, general governmental policy with respect to such matters as foreign relations, national security, GATT negotiations, currency exchange rates, and trade subsidies or restrictions can affect agricultural exports. Several specific governmental actions have also increased the demand for agricultural products or restricted their importation.

The Agricultural Trade, Development and Assistance Act of 1954, better known as PL-480, is perhaps the most significant agricultural trade legislation of the last 50 years. PL-480 currently provides for selling products on the basis of long-term credit and for emergency relief through governmental and voluntary relief agencies. In

fiscal 1982, the cost of the PL-480 program amounted to about \$1 billion.

Perhaps the most important thing about PL-480 is not what it costs but what it returns in future commercial trade and improved foreign relations. Over the years numerous countries that have received substantial PL-480 aid have later become major commercial customers of the United States. These countries include Taiwan, South Korea, Spain, and Israel.

The federal government has also promoted exports directly. In fiscal 1982 it provided about \$36 million for this purpose. These funds were used to directly support private commodity associations and other groups with a strong interest in export promotion.

Periodically, the United States government has sought to expand agricultural exports through various export subsidy schemes. For example, in late 1982 a blended credit program was initiated. Blended credit combines public funds at no interest cost with loan guarantees to the private sector.

No discussion of agricultural exports would be complete without acknowledging that governmental action has sometimes reduced exports. During the 1970's, the government interrupted the normal flow of agricultural exports to protect domestic supplies on at least three occasions. In 1980, sales of grain to the Soviet Union were halted for foreign policy purposes. In each instance farm commodity exports have been disrupted and prices depressed, although it admittedly is impossible to measure the extent of the loss. As a result of these policies, both the 1977 and 1981 Acts included protective provisions for American farmers in the event future embargoes are imposed.

Finally, U.S. policy has restricted certain agricultural imports through quotas and tariffs for many years. The legislative authority for limiting imports is a 1935 amendment to the Agricultural Adjustment Act of 1933, known as Section 22. Such restrictions now exist for dairy products, peanuts, sugar, and beef. While they are intended to protect the price of affected commodities, these restrictions can also be seen as inconsistent with efforts to expand exports.

Evaluation of Programs

Economic and Political Evaluation—Public policies for agriculture have undergone continuous evaluation. Part of this evaluation has been economic in nature, the remainder political. Political evaluation encompasses the entire public policy development process, from the time individuals initially perceive a problem to the point where decisionmakers reach some sort of policy compromise. A change in a program or its abandonment signals public disapproval, while continuing it signals public agreement. The public's evaluation of price and income policy for the agricultural and food sector,

reaching from the Federal Farm Board of 1929 to the Agriculture and Food Act of 1981, has resulted in signals of both approval and disapproval. However, shifts in program emphasis can best be characterized as incremental or evolutionary in nature.

In the 1984-85 period, policymakers will be sensitive to the recent high costs of commodity programs, the importance of international markets, and the economic well-being of farmers and the businesses serving them. The new law that emerges in 1985 to replace the Agricultural and Food Act of 1981 will reflect these concerns as well as others that may develop right up until a new act is signed into law.

Assessing Distributional and Other Economic Impacts—Evaluating past farm price and income-support programs is essential for those who must make choices about future programs. An overview of the impact of commodity, food distribution, and trade programs on six separate farm sectors follows.

(1) *Producers*—Commodity programs have at least marginally increased prices of farm products and incomes of producers for short periods of time. However, the rapid technical changes in farming, its competitive nature, the capitalization of farm earnings into land values, the inability to move resources into or out of agriculture quickly, and the exposure of farm markets to international trade have all combined to deny or erode income benefits over longer periods for individual farmers. Domestic food distribution and agricultural trade policies have also generally supported farm producers' incomes, although some trade interventions have disrupted them.

Economic analyses show that the benefits of price and income programs are generally proportional to size (market sales) of farms. This means that those farmers who produce the most generally receive the most absolute benefits, i.e., benefits proportionate to their size in the market, and conversely that farmers with smaller sales receive less benefits. Programs tend to protect the prices and incomes of farmers as a whole vis-a-vis those with whom they buy and sell but not to redistribute welfare among farmers. Cash payment limits (currently \$50,000) and minimum acreage quotas per farm have slightly tilted relative benefits away from the largest farmers, but these tendencies are probably counteracted by other indirect forces associated with size. Moreover, the payment limitation did not apply to the recent PIK program, in which millions of dollars worth of commodities were paid to some large producers.

Knowledgeable, efficient, economical, aggressive operators have more opportunities for expanding their scales of operation, their incomes, and their control of resources than do operators with the opposite characteristics. Price and income policies do not substantially alter these advantages. If the above characteristics of these expanding operators are also coupled with other

assets, e.g., inherited capital, their advantages are greater and their gains faster.

The longer run consequences of the stability or security which public price and income policies provide for the farm structure is unclear. Professionals argue that in the presence of economic uncertainty and stress the more efficient, knowledgeable, aggressive operators can expand faster than other operators. However, they also sometimes argue the opposite, that farmers expand their operations more quickly in an environment of economic prosperity and stability.

There is little argument, however, that during the past three decades there has been a relentless trend toward increasing numbers of larger commercial farms. During this period, the flow of off-farm income has consistently grown for all sizes of farms, but particularly for the smaller ones. For these farmers, employment opportunities off the farm are more important than price and income policies. Currently, off-farm income comprises over 60 percent of total income for the average farm family. In 1982, even farmers with gross sales up to \$100,000 earned this much or more of their net incomes off the farm.

(2) *International Trade and Interrelationships with Domestic Policies*—Throughout the history of U.S. price and income-support programs, the effect of these programs on agricultural trade has been an important policy issue. Moreover, this issue has increased in significance during the past decade as the proportion of total farm production exported grew from 15 percent to 30 percent. As long as there is no recognized international government, trade issues must be dealt with as a part of our national policy.

A wide range of national policies affect international trade. At times in the past, price supports have been set so high as to inhibit trade with other countries while export subsidies and "barter aid" have invited retaliation from them. However, present policies for most products support prices at or only slightly above average world levels, use direct payments, and even out market supplies over years. These policies generally support exports that have long run competitive advantages. Exceptions have been embargoes and the continued high support of dairy products, peanuts, and sugar. Trade is also adversely affected by import policies, including duties and quotas generally on these same few products and to some extent on meats.

In choosing programs, certain inexorable economic consequences of domestic policies to trade should be considered.

(1) Production control programs (e.g., marketing quotas) result in less products for export. As a result, foreign market opportunities may be forfeited. Likewise, if quantities of a product are reduced too much for domestic consumers, imports of this product may increase.

(2) Domestic price supports (e.g., nonrecourse loans) at levels significantly above average world prices reduce exports and increase imports.

(3) Price supports set above world prices and lack of effective production control must often be followed by subsidized exports and restricted imports.

(4) Direct or deficiency payments for producers increase production and hence export volume and also discourage imports unless other trade limits are simultaneously put into effect.

(5) Export subsidization (e.g., blended credit or food aid) and import restrictions (e.g., dairy import quotas), both adopted to serve domestic policy objectives, increase net agricultural exports.

(6) Finally, domestic consumer food subsidies (e.g., food stamps) affect trade only marginally by reducing food available for export or increasing the markets for imports.

Any of these program alternatives may trigger retaliatory actions. The lesson is clear. Price and income policies in the world today are still domestically determined within each nation, but rational policymaking for a country as agriculturally trade-oriented as the U.S. means that major consideration must be given to the interrelationships between domestic policy and trade.

(3) *Agricultural Input and Marketing Industries*—The economic well-being of farmers has generally been mirrored by the agricultural input and marketing sectors. When farming has prospered, whether by policies or other forces, so have agricultural businesses. A notable exception was the dramatic effect of the 1983 PIK program. While it generally benefitted farmers, it brought losses—even bankruptcies—to many suppliers of farm inputs. Like farm firms, agribusinesses have decreased in number and increased in size over the years. Commodity programs have probably stabilized agribusiness incomes in the same way they have stabilized farmers' incomes.

(4) *Rural Communities*—The economic welfare of a rural community reflects that of both producers and supporting agribusinesses. Thus more stability in farm product prices and farmer income translates to better economic health for the community. Since long-term income gains from programs have been marginal, they have provided only minimal gains to communities. However, the rural community has also been affected by persistent economic changes in the structure and operation of farming and its supporting businesses, changes largely unrelated to public price and income policies.

(5) *Consumers*—Consumer welfare is affected by the quality of food, its plentifulness, and the efficiency of its production. At times price supports, production control, trade, and food distribution policies have probably directly increased food prices. But such programs, along with income supplements, have also generally supported

an adequate, stable, and generally efficiently-produced food supply.

In the absence of price and income-support programs, it is likely that consumers would have periodically experienced lower prices as the "surpluses" cleared the market. Or they might have benefitted from more efficient production in some sectors as less efficient producers were "driven out." At some point, of course, the surviving producers might have attempted to gain collective control of the market, which would not have been a good omen for consumers. Using such measures as real costs, quality, quantity, and proportion of income spent to obtain food and fiber, the effects of these policies are uncertain but they are likely to vary among commodities. Food distribution and nutrition programs have directly benefitted lower-income consumers while also aiding producer prices and incomes.

(6) *Treasury Costs*—The cost of price and income policies has been substantial and growing, albeit erratically (Table 2).

Table 2—Commodity Credit Corporation Price Supports and Related Expenditures, Fiscal Years 1961-1983 (in millions of dollars).

<i>Year</i>	<i>Major crops*</i>	<i>Dairy</i>	<i>Other†</i>	<i>Total</i>
1961-1964 Avg.	1,546	236	437	2,219
1966-1970 Avg.	2,287	142	389	2,818
1971-1975 Avg.	1,795	196	398	2,389
1976-1980 Avg.	2,058	357	932	3,347
1981	1,370	1,894	736	4,000
1982	8,989	2,300	309	11,598
1983 (Projection)	13,517	2,190	5,393	21,100

Source: Congressional Budget Office from U.S. Department of Agriculture data.

**Wheat, feedgrains, rice, and upland cotton.*

†Includes other commodity programs, interest, and administrative and nonadministrative expenses.

Even though half of the increase in expenditures during the 1970's is due to inflation, the big increases during the 1980's are real and dramatic. They are particularly troublesome in light of rising overall budget deficits. It is a real political concern that these large amounts are spent directly on an economic sector that represents only three percent of the population, especially when the distribution of benefits is keyed to the volume produced. The 1981 decision to offer small inducements to crop farmers for meager supply control explains the relatively low expenditures that year. The subsequent escalation of costs was necessary to handle the excessive supplies of two record crop years. The increasing reliance upon direct payments and voluntary production controls has shifted the burden of supporting farmer incomes from consumers to taxpayers.

The fiscal impacts of domestic food aid policies rose dramatically during the late 1960's and throughout the 1970's, reaching \$16 billion a year, but they have now been slightly reduced.

Price and Income Policy Issues in the Future

Public Policy and Private Policy—Over the past two centuries U.S. policies for agriculture and food have produced a highly productive system of private enterprises operating in a market system *within* a network of public (governmental) working rules, guidelines, and institutions. Our unique educational and research institutions, family farm agriculture, cooperative credit network, soil conservation agencies, and market information and quality control services were set up by public policies. More recently, the various price and income programs, as well as food programs, emerged with the same public sanction.

Whether public price and income policies will continue depends upon the citizens' choices in view of future economic conditions and problems.

Probable Future Problem Areas—Price and income programs that do emerge are sure to be set up in response to perceived public problems. Some of these potential problem areas can be identified.

(1) *Instability*—After two decades of increasing stability in farm production, farm product prices, consumer prices, and agricultural export flows, the 1970's ushered in increasing economic instability throughout the agricultural and food sector. This instability appears to be propelled particularly by U.S. dependence upon foreign markets—many dominated by their respective governments—but also by unusual weather conditions, farmers' reliance upon borrowed capital, unsettled money conditions, and floating international exchange rates.

Fluctuations in a market system can contribute useful price signals, shift resources to better uses, and economically reward efficient management. Yet when market variations deteriorate to volatile instability and extreme economic uncertainty, they result in severe investment losses to producers, idle resources, increased costs for covering risk, and shortened planning horizons. Farmers rely increasingly on borrowed capital (its debt to asset ratio doubled from 1950 to 1982). Furthermore, part of this debt is incurred for nonreal estate production purposes. Hence farmers have more difficulty adjusting to instability by simply reducing their living expenses and interruptions of their cash flow quickly threaten their equity positions. Beginning farmers and commercial operators experience the greatest difficulty. If the instability appearing in the past decade continues, producers, agribusinesses, and consumers are likely to call upon public price and income policy for relief.

(2) *Excess Productivity Capacity—Temporary or Chronic*—From the 1930's through the decade of the 1960's, bypassing the War years, an image of excess land and labor resources prevailed. Yet in the 1970's, this image faded and its fading was reflected in various

publications, in rural thinking, and in official governmental pronouncements. During the past two years, this image has reemerged with vigor.

If annual rises in farm output average near 2 percent, while domestic population and income growth generate 1 percent or less in added demand, the rapid net trade-generated demand growth of the first half of the 1970's would have to come back to provide a semblance of supply-demand balance. Trade-generated demand growth dropped to under 1 percent annually during the last half of the 1970's.

Chronic excess agricultural capacity could be the scourge of the future, but capricious weather, natural production hazards, and slowly emerging technology could also switch the issue to a fear of food shortage. World economic and political forces seem able to respond quicker to food deficits than to surpluses; similarly, period of surpluses seem to last longer. In either case, public price and income policy is likely to be relied upon to moderate the economic stress alternatively to producers or consumers. Such policy is probably needed because supply and demand balanced sufficiently to avoid dramatic swings in prices seems unlikely to emerge as the pattern of the future.

(3) *Expectations of World Food Production*—U.S. commodity prices and farm incomes are likely to be greatly affected by world conditions in the foreseeable future. U.S. farm output, compounding at a 1.8 percent annual rate in the post World War II period, has consistently exceeded growth in domestic population and demand for this output generated by increased incomes. However, world population is likely to continue to grow around 2 percent annually for at least a decade and rising incomes in other countries also increase food demand.

If developing countries, where 75 percent of the world population lives, can consistently increase their food production at least as fast as their populations and if income increases generate growth in demands for food (a favorable world scenario), the prospects for continued growth in demand for U.S. exports of agricultural products will be dim. U.S. agriculture would then be under chronic price and income pressure. If, on the other hand, growth in food production in developing countries is less than 2 percent annually, and these countries obtain the same purchasing power (an unfavorable world scenario), prospects for U.S. exports would be brighter and the need for price and income policies might be reduced. However, U.S. production, marketing, and pricing must remain competitive, because other large agricultural exporters—Canada, Australia, Brazil, Argentina, EEC, and even emerging exporters among developing countries—will also stand ready to respond to growing world food needs.

(4) *Future of World Trade Restrictions*—Since adoption of the General Agreements on Trade and Tariffs

(GATT) in 1947, the prohibitive trade barriers of the early 1930's have been reduced. Even though some trade restrictions have persisted, often of nontariff types and on certain agricultural products, world agricultural trade has mushroomed twentyfold during the past quarter century. As indicated above, world food needs imply that there is a strong potential for expanding trade even more. But the companion ingredients of political stability and the propensities for moderating trade conflicts are much less evident.

Growing frustration with nationalistic trade barriers—and in some cases, deeper political antagonisms—could conceivably lead to a serious trade war. Such a scenario could hardly benefit American farmers. It would result in pressure to provide additional public assistance to agriculture. If, on the other hand, trade barriers can be reduced, then increased U.S. exports can relieve the pressure for new price and income policies.

Closing Observation—Whatever future price and income policies come forth as responses to these possible problem areas, they may simply be traditional, familiar packages of instruments slightly retuned. Alternatively, program innovations to better ensure stable prices, secure incomes, adequate food, reliable trade, and fiscal responsibility, might appear. These could involve such principles as insurance, targeting programs for particular regions, declining compensation, self-help, and indexing. Finally, price and income policies might be designed as “change instruments” on behalf of the public. Such policies could be used to conserve land or water, disperse population, improve nutrition, redistribute income, influence structure and control of the family farm, shift enterprises, improve environmental quality, and bring about desired trade flows.

Selective alternative farm price and income-support policies which exemplify the range of choices follow.

(1) Gradually phasing out all support policies, payments, production controls, and trade interventions, letting domestic private market decisions determine pro-

duction, prices, incomes, and trade, with other nations pursuing their own national policies.

(2) Supplementing the choice above only with a partially publicly subsidized national income insurance and futures price option program designed to facilitate private risk management by farmers.

(3) Gradually phasing out all price and income policies except for a recourse loan program to even out farm prices during the marketing year and a minimal farmer owned grains reserve recourse loan program to provide national food and trade security.

(4) Continuing the provisions of the 1981 Act, modified by setting up a maximum grains reserve as well as a minimum grains reserve, indexing price supports to recent multi-year market price averages, indexing target prices to recent multi-year costs of production including some land costs, extending payment limitations to in-kind as well as monetary payments, and linking production control benefits to soil conservation performances.

(5) Replacing voluntary production control with compulsory control following farmer referenda supervised by a new national marketing board, relying more on higher support prices instead of Treasury payments, aggressively negotiating international commodity agreements, and restricting imports to protect domestic markets.

Choices among these and other options will be greatly affected by future developments in likely problem areas mentioned earlier—economic instability, excess capacity, world food production, and world agricultural trade.

When public policies are viewed as instruments, institutional creations, or responses to society's demands, rather than as rigid goals, scientific norms, or embodiments of ideology, one can envision infinite possibilities for their future use. The challenge to those shaping public policy is to keep as many program options open as possible and to be certain that the public understands both the alternatives available and the probable consequences of these alternatives.

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Monetary and Fiscal Policy Connections to Agriculture

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THE ECONOMIC PERFORMANCE of the agricultural sector can no longer be viewed as independent of the rest of the domestic and world economies. Both long-term trends and recent legislative changes have combined to reduce the isolation of agriculture from national business cycles. The long-term trend of declining rural populations seems to have run its course. Total personal incomes of farm families have reached levels which are close to those of nonfarm families. Perhaps even more important is the decade old trend toward more agricultural exports. Today, about one-third of the acres planted in the United States produce food and fiber for export. Moreover, recent changes in banking legislation have made rural credit markets more responsive to changes in national financial conditions, so the business of food production now competes directly with other sectors for financing.

Because of these changes in the economic environment faced by the U.S. agricultural sector, the well being of the United States and world economies is of critical importance to farmers, their suppliers, and food processors. The health of the economy is, in part, determined by the economic policies of the government. These policies come in many forms. Two forms are considered in this paper — monetary and fiscal policy. Monetary policy is concerned with the creation of money and credit. Fiscal policy deals with the receipts and expenditures of the government. Together they play a central role in determining the condition of the economy.

The purpose of this paper is to trace the effects of changes in monetary and fiscal policies on the economic condition of agriculture. Given such a broad scope and limited space, many debatable points are given only limited attention and the interested reader is encouraged to study the issues in more detail in the references listed at the end of the paper.

The first section of the paper describes the links between the agricultural sector and other sectors of the economy. The next two sections are devoted to

explaining monetary and fiscal policies in more detail. The fourth section describes the interactions between monetary and fiscal policy, demonstrates how these policies change economic conditions, and points out how these changes affect agriculture. The fifth section discusses some of the macroeconomic policy prescriptions currently being debated. Finally, the last section offers some concluding comments.

Connections Between Agriculture and the Rest of the Economy

There are three principal links between agriculture and the rest of the economy: the purchase of inputs, the sale of outputs, and the acquisition of external financing.

Input Purchases

Over the years, nonagricultural input purchases have become more important to farmers and food processors. Farmers spent 37 percent of their gross receipts on purchased inputs in 1981, compared with 26 percent in 1950. The value of nonfarm inputs in retail food sales has increased from 53 percent in 1950 to 72 percent in 1982. The agricultural sector has, therefore, become much less self-contained over the last 30 years.

The costs of nonagricultural inputs play an important role in determining the profitability of the sector. Any event that raises the costs of inputs without increasing revenues to offset these costs will reduce profitability. One example of such an event was the rapid increase in petroleum prices during the 1970's. Not only did fuel become more expensive, the prices of fertilizers and chemicals also escalated. Higher petroleum prices also reduced consumer demand for food. Thus petroleum price shocks were in part responsible for the cost-price squeeze experienced by farmers during much of the latter half of the 1970's.

Another example cited by some agricultural economists is that inflation reduces farm incomes. There

The views expressed are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of Kansas City or the Federal Reserve System.

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are several reasons why this might be so. One reason is that farming is more competitive than other sectors of the economy. Farming is done by a large number of individual firms that may find it more difficult to pass along higher costs than the smaller number of firms selling farm inputs. It could also be that farm income is measured improperly during times of inflation, since this measurement does not account for the declining value of farm debt or the appreciation of farm assets. Finally, it can be argued that inflation causes a misallocation of resources in the general economy, reduces the real value of consumers' incomes, and thus holds down the profitability of all businesses including farming.

The valuation of durable inputs to agriculture, such as land and equipment, is also influenced by general economic outcomes. A rapidly growing economy generates increased levels of business investment. Since farm implement suppliers must compete against other manufacturers for labor, steel, and other inputs, rapid growth in the economy forces up their costs and increases farm machinery prices. Farm real estate is another agricultural input whose value is, in part, determined by economic forces outside of the sector. Inflation may drive up land prices as investors (farmers included) search for real assets to protect their wealth. Rapid growth in the economy also increases the value of farm real estate by removing land for commercial and residential construction.

Output Sales

Another important link between agriculture and the rest of the world's economy is the demand for food. Domestic consumer income, population growth, and the prices of other consumer goods are important determinants of the prices received by U.S. farmers. About two-thirds of the food produced in the United States is consumed domestically, so domestic economic conditions play a significant role in determining food prices. Population growth assures that more food will be desired, but the ability to buy food is constrained by growth in incomes and the costs of other necessities such as housing, utilities, and health care. There are, of course, other factors which change the demand for farm commodities, such as interest rates and the level of consumers' wealth.

Exports of U.S. agricultural products are principally determined by growth in world population, foreign incomes, other governments' policies, and foreign food production. Population growth is the principal driving force behind the growth in demand for food in the poorest developing countries. In these countries, a variety of means is used to increase available food supplies to meet basic caloric needs, including foreign aid, credit extensions, and at times military force. Once basic food needs are met, how-

ever, income growth and the openness of foreign markets play a more important role in determining the demand for U.S. agricultural exports.

Exchange rates and trade barriers can also affect the demand for U.S. food exports. An increase in the value of the dollar versus another country's currency is the equivalent of a price increase of U.S. goods to consumers in that country. For example, between 1980 and 1982, the value of the U.S. dollar increased by more than 33 percent against a trade weighted average of 10 other countries' currencies. So, on average, consumers in other countries found that U.S. goods cost one-third more than they did in 1980 simply due to movements in exchange rates. Other things remaining constant, an increase in the value of the dollar would reduce foreign demand for U.S. food exports. The growth in U.S. food exports can also be decreased by foreign barriers to free trade. These barriers to trade may exist to encourage a foreign country's self-sufficiency in food production or as a retaliation to U.S. barriers to agricultural and non-agricultural products.

As economists have noted in recent years, credit cannot be a permanent substitute for income when buying groceries or other consumable products. Many of the current financial difficulties of the developing nations and centrally planned economies can be attributed to their use of debt to finance current consumption. While debt financing increased U.S. agricultural exports during the 1970's, ensuing financial problems in the 1980's will continue to play a role in slowing growth in export sales. Foreign nations heavily burdened with debt must first earn foreign exchange to service their obligations. Only after that will they be able to afford increased imports of food.

External Financing

Finally, agriculture is tied to the other sectors of the economy through financial markets. The cost of borrowing money and the return available on nonfarm investments help determine the amount of investment in the agricultural sector. In the past, investments by large agribusiness corporations and cooperatives were tied to national financial markets, while rural agribusinesses and farms were somewhat insulated from fluctuations in interest rates. More recently, with the evolution of new financial instruments, the deregulation of U.S. financial markets, and the trend to variable interest rate loans, this isolation has been reduced. Changes in national financial market conditions now have a more direct and immediate effect on all participants in agriculture.

While there are many economic indicators that can be used to identify the condition of the general economy and the influences of the general economy on agriculture, some of the most important are the level

of domestic incomes, the rate of inflation, the exchange rate, and the level of interest rates. The remainder of this paper will focus on how monetary and fiscal policies change these critical measures of economic performance and either help or hinder agriculture.

Monetary Policy

U.S. monetary policy is conducted by the Federal Reserve System, which was created by Congress in 1913 to oversee the creation of money and credit and to control the value of the currency. While the System shares the legally mandated macroeconomic goals of the whole government — full employment of resources, stable prices, and a satisfactory rate of economic growth — its primary focus is on general price stability. If too much money is created, inflation results with its attendant costs to the economy. If too little money is created, disinflation or deflation and losses in economic output are incurred. A major goal of the Federal Reserve System, therefore, is to create the right amount of money and credit so the productive resources of the economy are fully utilized, but not so much that there is inflation.

Tools of Monetary Policy

To understand monetary policy it is necessary to know what money is, yet money is not easily defined. Many things could be called money, such as currency, checking accounts at banks, savings accounts, certificates of deposit, and even lines of credit on credit cards. Different definitions of money, referred to in financial publications as M1, M2, etc., have arisen to serve different purposes. In this paper, money will refer to pocketbook and checkbook money, currency in the hands of the public, and the equivalent of checking accounts at all depository institutions (M1). At the end of 1982 there was about \$133 billion in currency and \$346 billion in checking accounts in the United States, for a total amount of money of about \$480 billion.

The amount of currency is increased whenever it is ordered by banks from the Federal Reserve and distributed to the public. When the currency is delivered, banks pay for the bills and coins by having the cost charged against their accounts maintained at the Federal Reserve.

The creation of checking account balances (demand deposits) is not quite so simple. The banking system as a whole can create demand deposits by making loans and then crediting their customers' checking accounts with the amount of the loan. Without constraints banks could, therefore, create an infinite amount of money. Legally, however, banks must keep a certain fraction of their deposits in reserve to be sure they can cover the transactions of their cus-

tomers and meet other business obligations. Because of these laws, banks cannot make loans for the total amount of the deposits they create. The amount of reserves they are required to hold places a limit on the amount of money the banking system can generate. These reserves must be held either as cash in the banks' vaults, special classes of securities held by the banks, or in the form of deposits with the Federal Reserve either directly or through correspondents. The Federal Reserve can control the growth in money and credit by setting reserve requirements and by creating or removing banking system reserves.

There are three principal ways the Federal Reserve controls growth in the money supply. Most commonly it creates reserves by purchasing government bonds and crediting banks' reserve accounts in payment. These actions are called open market operations. Banks can also borrow reserves from the Federal Reserve at an interest rate called the discount rate. Generally, a lower discount rate results in increases in these borrowings which add to reserves. The level of reserves is decreased when the Federal Reserve sells bonds or decreases its loans to banks. Finally, the Federal Reserve can adjust the fraction of deposits that must be held as reserves. A lower fraction would allow more money to be created for the same amount of reserves. This is a powerful but blunt tool for the implementation of monetary policy and, as a result, is seldom used.

While their use may be imprecise, these tools allow the Federal Reserve some control over growth in money and credit in the economy. The next step in studying monetary policy is to understand how decisions are made regarding the appropriate amount of money.

Determining the "Right" Amount of Money and Credit

Growth in money and credit not only influences the rate of inflation, but also has an impact on the level of interest rates and economic activity. Over a short period of time, more money means lower interest rates and faster growth in economic output. For example, consider an open market operation. To increase the money supply, the Federal Reserve buys government bonds. Since there are fewer bonds available to be purchased by private investors, the price of bonds is bid up and interest rates decline. More importantly, as the extra reserves created by the Federal Reserve's purchase are invested by banks, more loans are available, and the interest rate on loans falls.

For a long time the Federal Reserve focused on interest rates as an indicator of whether or not growth in money and credit was satisfactory. A market interest rate (typically the rate on overnight interbank borrowing — the federal funds rate) believed to be con-

sistent with the desired rate of growth in money and credit was selected and maintained within a narrow range by open market operations, until it became apparent that the desired growth in money and credit required a change in interest rates.

During most of the post-World War II period efforts were made to use monetary policy to dampen the swings in economic activity inherent in business cycles. In a boom interest rates were supposed to be high to slow inflation, and during a recession interest rates were to be low to encourage recovery.

Unfortunately, this method of implementing monetary policy seemed to favor long-term increases in the rate of inflation. It was easy to decrease interest rates during a recession, but much less popular to increase interest rates in times of rapid economic growth. Thus, on average, interest rates remained too low and the growth of money and credit too high. Over long periods of time excessive money growth created inflation. As savers required that the value of their investments grow to match the inflation, upward pressure was applied on interest rates, and even greater growth in money and credit was required to prevent interest rates from climbing still higher.

In 1979, the Federal Reserve changed its operating procedures to emphasize control of the growth of some narrow measures of money (M1 and M2) as intermediate targets, rather than control of interest rates. Once interest rates were freed to find their own level in the market, they rose dramatically. As a consequence of the new operating procedures, however, money growth has slowed, the rate of inflation has decreased, and interest rates have declined.

Exchange Rates

Monetary policy also plays a critical role in determining exchange rates. An exchange rate is the value of the goods and services that can be purchased by one dollar versus the value of goods and services that can be purchased by one unit of another country's currency. Since inflation is a measure of the decline in the value of money, relative rates of inflation across countries are important in determining exchange rates.

The Federal Reserve System, by restraining the rate of inflation in the United States, helps to preserve the value of the dollar versus other currencies. If, as has happened recently, the rate of U.S. inflation slows more quickly than inflation in other countries, the value of the dollar increases. This has a tendency to discourage U.S. exports by making U.S. goods more expensive to foreign buyers, and to encourage imports by making foreign products less expensive to U.S. consumers. Thus rapid reductions in inflation have foreign trade consequences that reduce domestic production.

The Impacts of Monetary Policy

Monetary policy has primary impacts on inflation and exchange rates, both of which are important to agriculture. Inflation and exchange rates have their own impacts on domestic income which is another important determinant of the economic well-being of agriculture. Monetary policy does not operate in a vacuum, however. Fiscal policy is also important and can either work with or against monetary policy in achieving economic goals.

Fiscal Policy

Fiscal policy is the combined effects of the government collecting taxes, purchasing goods and services, lending money, guaranteeing loans, and paying out money to individuals in the form of social security, welfare, unemployment, and subsidy payments. As such, the programs that are normally considered farm policies form only part of fiscal policy. For example, commodity programs are partly transfers from other taxpayers, partly purchases of goods and services, and partly lending programs. Fiscal policy actions are taken not only to pursue the economic goals of full employment, price stability, and satisfactory growth, but also to provide public goods such as national defense and to more equitably distribute output.

The principal federal fiscal policymakers are Congress and the President. A federal budget is proposed each year by the President. The houses of Congress introduce, debate, change, and pass budget legislation. The President then has the right to approve or veto congressional tax and spending bills. It is through this process of political debate and action that the priorities for different economic goals in fiscal policy are determined.

The Tools of Fiscal Policy

There are many tools of fiscal policy including setting tax rates, individual program appropriations, the levels of direct government lending, and the levels of government loan guarantees. Each has a slightly different impact on the economy. Some, such as the purchase of a specific agricultural commodity, encourage one type of output rather than another. Others, such as income tax rates, have more of an impact on the growth of the overall economy. This paper will concentrate on the impacts of fiscal policy on the overall size of the economy, leaving the effects of farm policy to others.

The Deficit

In trying to summarize the impacts of fiscal policy on the growth of the economy, most economists analyze the size of the government deficit, which is the amount by which government expenditures exceed

government receipts. With a fiscal policy characterized by deficit spending, government expenditures stimulate the economy more than output is decreased by taxes. Over a short period of time, this stimulus might generate increases in total income several times its original magnitude, as initial government purchases generate income to workers who then spend the money, producing income for other workers.

The full employment deficit — how much government payments would exceed tax receipts if the economy were fully employed¹ — is, perhaps, a better indicator of the type of fiscal policies being pursued than the actual deficit. Part of the deficit in a recession year is an automatic response to the slowdown in economic activity. During a recession, tax receipts fall and payments of unemployment and welfare benefits rise. If a full employment deficit exists, however, fiscal policy is stimulating economic activity beyond what is needed for a return to full employment.

The long run impacts of government deficits may be quite different than those of the short run. Federal budget deficits may be useful in the short run to stimulate our economy in recession. But deficit financing over long periods of time almost certainly reduces economic growth. The Treasury Department must finance the deficit by issuing government bonds. This absorbs some of the pool of available credit that might be used by the private sector for capital investment and job formation or by consumers to increase their purchases. By adding to the demand for credit, a deficit increases interest rates in the long run and may, therefore, slow economic growth.

Before World War II, most deficits occurred in years of wars and depressions. Peacetime was viewed as a time to run a surplus to pay off government debt. Since World War II, however, the federal budget has incurred a deficit 31 of 38 years. In addition, inflation has combined with progressive tax rates to increase Federal taxes' share of the gross national product from 19 percent in 1960 to 21 percent in 1980. More recently, large federal income tax rate reductions have combined with only a gradual slowing in the growth of government expenditures to generate large and growing deficits. The deficit was only \$28 billion in 1979, but was over \$110 billion in 1982 and is expected to be over \$200 billion in 1983. The deficit accounted for 1 percent of GNP in 1979, but is expected to be more than 6 percent of GNP in 1983. Even in terms of a full employment deficit, projections for 1983 show significant stimulation of the economy.

The Impacts of Fiscal Policy

Government deficit spending, therefore, has a positive short-term impact on domestic incomes which

help determine the demand for food. In the longer term, if economic growth is slowed, income growth is slowed as well. Moreover, continued deficits may increase interest rates which increase the costs of food production and further decrease the demand for food.

Macroeconomic Policies, the Business Cycle, and Agriculture

Monetary and fiscal policies can either complement each other or conflict with each other in moving toward economic goals. The difference in these two approaches may be seen in the financial markets. When the policies work together, their impact on interest rates is small. When they conflict, interest rate changes can be large.

For example, assume there is a desire to reduce inflation. One approach would be to have monetary policy, determined by the Federal Reserve, and fiscal policy, determined by Congress and the President, complement each other by decreasing the deficit and slowing growth in money at the same time. The Treasury would be trying to sell fewer bonds and the Federal Reserve would be buying fewer bonds. In this case, interest rates might change very little. Another approach would be to have the policies in conflict by slowing growth in money and at the same time to stimulate output by running large government deficits. In this case, the Treasury would sell more bonds while the Federal Reserve would decrease its purchases. The result would be rising interest rates, due to increased competition for the available pool of credit, and a shift of income away from sectors of the economy such as housing, automobiles, and agriculture that are sensitive to interest rates.

The Business Cycle

Over the years, monetary and fiscal policies have been used to stimulate and restrain the economy. Typically the U.S. economy has gone through alternating periods of expansion and recession. One of the central debates in economics is whether the public sector or the private sector is ultimately responsible for these fluctuations. The answer to the debate is that both probably contribute. There have been times, such as the mid-to-late 1960's, when government policies have been overly stimulative and started periods of unsustainable growth. At other times business cycles have originated in the private sectors of the economy. Certainly the causes of some fluctuations in economic activity, such as the oil and food price shocks of the 1970's, may have been beyond government control.

No matter what the ultimate cause, the typical business cycle follows a familiar pattern. Starting from a situation of economic growth at a rate that

does not generate inflation, something happens to stimulate demand. The economy then enters an expansionary period and inflation eventually starts to accelerate. During this time, more labor is provided than can be sustained by inflation adjusted wages, because workers are not fully aware of the decline in the purchasing power of their paychecks. As workers learn of the increased rate of inflation, they demand higher and higher wages. This leads to even higher rates of inflation as businessmen begin to increase prices to protect incomes. At some point, political pressure builds for instituting anti-inflationary monetary and fiscal policies.

When restrictive policies are implemented, demand is constrained, inventories build, output declines, and the economy enters a recession. Unemployment rises as firms cut production. Rising labor costs based on contracts negotiated during previous periods of rapid inflation accentuate the layoffs. Pressures build to sell off inventories and inflation starts to decline.

The final stage of the business cycle is a recovery in the economy back to a sustainable level of growth. Inflation continues to decline because of the lower rates of increases in wages built into contracts negotiated during the recession and the recognition that inflation is actually lower. Businesses increase production to meet rising sales and eventually unemployment declines.

Anytime during these cycles of expansion, recession, and recovery, a new influence such as a war, a crop failure, an oil price shock, or an unusual change in government policies can appear. If so, movement to the next phase of the cycle can be postponed or promoted. The timing of the cycles, therefore, has varied considerably over the years.

The Business Cycle and Agriculture

Agriculture goes through many of the same gyrations as the rest of the economy during these cycles, although special factors such as weather can put the agricultural economy out of phase with other sectors. Within the past decade though, economic conditions in agriculture have become more dependent on conditions in the rest of the United States and world economies.

Agriculture has recently become more closely tied to the rest of the economy and some impacts of business cycles on agriculture may be recognized from the conditions of the last few years. During the early part of an expansion, demand for food is expanding and profits are likely to be increasing. Inflation has just started, so real estate values have not become a burdensome cost of production. In the latter portions of an expansion, however, agriculture is caught in a cost-price squeeze and current returns decline. Farmers receive a larger portion of their total returns in the

form of unrealized capital gains on real estate, since inflation is now being built into everyone's expectations. These increases in land values do not, however, pay the bills unless farmers borrow against them, so cash flow pressures build. Food processors and input suppliers are also making their returns from gains in inventory revaluation. This decreases their cash flow and puts them in the position of increasing their debts as well.

Once anti-inflationary policies are put into effect, all of the agricultural sector suffers. The amount of suffering depends, in part, on how long the expansion has lasted and what combination of macroeconomic policies is used to fight inflation. Long periods of inflation increase the incentives to debt finance to the point where even cautious managers increase their leverage. If, as has recently been the case, monetary policy is used as the primary policy tool to fight inflation, interest rates rise sharply during disinflation and the impact on firms with debt is large. Unless other countries' inflation rates decline as fast as that of the United States, agriculture also suffers during this period because the slowing of inflation is likely to increase the value of the dollar relative to other currencies and thus slow agricultural exports.

Finally, as inflationary expectations decline, recovery starts and provides relief to food processors and, to some extent, to farmers. Current returns improve. Farmers are still likely to incur unrealized capital losses on farm real estate, however, since inflation is declining. Their purchases of inputs, particularly large investments such as machinery, are therefore likely to be constrained, and thus farm input suppliers are the last to benefit from improvements in the general economy.

The Impacts of Business Cycles

While business cycles may provide periods of rapid growth and prosperity for agriculture and for the rest of the economy, at other times they cause great problems and human suffering. The uncertainty caused by fluctuating profitability generally tends to decrease investment and reduce long-term growth in the economy.

Business cycles also have a tendency to concentrate wealth. Imagine an economy where everyone started out with the same wealth at the beginning of a recovery. Given normal variations in human behavior, many would do well and some others poorly during the recovery. Accelerating inflation favors those with more real assets and those who build their businesses with debt. A small number of these individuals would either be smart enough or lucky enough to reduce their debts prior to the recession. Others would not, and would return to average wealth or less. Over the course of succeeding business cycles

the few remaining wealthy individuals would then be in a position to gain even more at the expense of the losers.

At certain times in the business cycle inflation is associated with slow growth in output. During these times agriculture suffers a continuing cost-price squeeze and growing cash flow difficulties. Slow growth in the economy results in slow growth in food expenditures. Rapid inflation drives up the costs of agricultural inputs. Taken together, these two effects reduce current returns to agriculture. Inflation does, however, drive up the value of real assets, providing an increase in wealth that can be used as collateral for loans. As borrowing is used to supplement low current returns, the fixed costs of producing food rise. Financial risks of cyclical declines in profitability become greater and the farm and food sector is then poised to enter a period of financial distress.

Possible Policy Prescriptions

There are many reasons why greater economic stability is desirable for agriculture and for the rest of the economy. This section describes the goals and the likely impacts of some alternative policies that economists have suggested as better ways to achieve stability. As it turns out, many of these alternatives are either counterproductive or have side effects which may be worse than the problems they are designed to cure.

Price and Wage Controls

Some economists argue for price and wage controls as an additional tool to help monetary and fiscal policies in fighting inflation. They suggest that the actual level of inflation is largely determined by the level of inflation people expect. By having the government guarantee that prices and wages will not increase faster than some stated rate, they believe that expectations can be reduced and inflation diminished with small increases in unemployment. Given that appropriate steps are taken by government to dampen underlying inflationary pressures, wage and price controls could be helpful in reducing inflation more quickly, and with a smaller increase in unemployment, than could be achieved without them.

There are, however, several problems with this approach. Price and wage controls weaken the incentives for the government to deal with the underlying problems of the economy. When prices cannot adjust fully to the pressures in the economy, it is easy to justify deficit spending or expansionary monetary policies to increase employment. As shortages of goods become more and more visible, the controls are eventually removed and the results of inappropriate policies can be quickly seen in rapid inflation.

Price and wage controls also keep prices from ad-

justing to market clearing levels. If controls are to be effective, they must hold the prices of some goods to less than those that would be observed in an uncontrolled market. When this happens, more of these goods will be demanded than will be supplied. The question of who gets available supplies must then be determined by all sorts of means including first come, first served (gasoline lines), black markets (where a higher price is actually paid), or government decree. These pressures usually lead to waivers on the prices of some goods and eventually to the complete breakdown of the system of controls.

Balanced Budget Amendment

Some economists argue that fluctuations in economic activity during business cycles are increased by the government's deficit spending and that fiscal policies designed to smooth economic fluctuations take so long to implement that they actually accentuate business cycles. They suggest that the government budget should be balanced by law, since political forces tend to generate continuing deficits.

While the concept has some intuitive appeal, it also suffers from some basic flaws. It is not clear whether the budget should be balanced irrespective of prevailing economic conditions, or if it is the full employment budget that should be balanced. If the budget is to be in balance under all conditions, then government actions will accentuate the cycles of the economy. In years of recession, government expenses would have to be cut since tax revenues would be lower. In times of rapid growth in incomes and tax receipts, the government might stimulate demand by spending more. Both would be counterproductive with regard to economic stability.

Balancing the full employment budget also has problems. First, full employment must be defined. Since the 1960's, many economists agree that the natural rate of unemployment, the rate that would be observed simply by people changing jobs when economic conditions are good, has grown from 3 or 4 percent to 6 or 7 percent. By deciding on a natural rate of unemployment each year Congress could pass any desired budget. Another way that the law could be circumvented would be by making unrealistic economic forecasts. The government controls only tax rates, not tax revenues. If the Congress wanted to increase expenditures, it could simply agree on an unrealistically high forecast of economic growth in the coming year. Given expectations of faster growth, more tax revenues would be anticipated and the budget would be balanced. Indeed, just such reasoning has been employed on more than one occasion. Finally, and not without historic precedent, off-line budget items could expand. Agencies could be created to fund congressional projects which do not appear in the budget and would, therefore, not influ-

ence the "balanced budget." It seems then the balanced budget amendment is a law that is not only impossible to enforce, but also if followed, one that could lead to even greater economic instability.

Fixed Rules for Controlling Money Growth

In recent years many have argued for a policy of requiring money growth to be constrained by some arbitrary rule — or by the growth in the quantity of some commodity such as gold. The basic premise behind these suggestions is that the discretionary monetary policies of the Federal Reserve add to the fluctuations of the economy. Forcing the money supply to grow at a constant rate is supposed to reduce or eliminate inflation and stop fluctuations in output and employment. While this idea has some intuitive appeal too, it also suffers from some major flaws.

Proponents of the gold standard, for example, point to the 19th century to support their arguments that tying the available supply of money to gold will control inflation. They are probably correct in saying prices would remain about the same over long periods of time. Unfortunately, the stability of the economy during the 1800's left something to be desired. Instead of having recessions, the economy suffered through repeated depressions caused by financial panics. It was one of these collapses in the financial system that brought about the Federal Reserve System in order to provide an "elastic currency." In other words, after living through the economic fluctuations caused by having growth in money tied to the value of gold, people demanded that discretion be used in creating money, so money and credit would be available when needed.

A gold standard is a particularly troublesome policy option, since it is not simply neutral to economic fluctuations. It may actually make them worse. In poor economic times, countries would find both their own citizens and foreigners redeeming money for gold. The money supply, therefore, would decline at just the time more money was needed for a recovery. Finally, even gold standard advocates disagree about how gold would be initially priced and how its price could be adjusted, if necessary — two fundamental difficulties in implementing a gold standard.

A fixed policy of money growth also suffers from at least two major operational difficulties. The first is in defining fixed growth. Certainly normal yearly fluctuations in the demand for money should be accommodated. Hardly anyone would argue for higher interest rates in response to the increased need for money at the end of the year due to the holiday season. Yet once the rule becomes even somewhat flexible, it is extremely difficult to draw distinctions between seasonal fluctuations and cyclical changes in the demand for money. The second operational problem comes from the difficulties of defining money. When a fixed

rule starts to constrain the growth of money, financial markets tend to develop new kinds of deposits or investments which serve the same purpose as money but which are not restricted. Thus with deregulated financial markets, precise short-term control over the growth in money and credit may be impossible.

Conclusions

Business cycles are not going to be eliminated from the economy in the foreseeable future. With the growing interdependence between agriculture and other sectors of the economy the search for better macroeconomic policies will probably occupy more of the time of the groups representing the agricultural sector. And an understanding of macroeconomics will be more important for participants in agriculture.

Since budget deficits loom as the biggest near-term problem in macroeconomic policy, it is unlikely that the government will provide greater subsidies for any special interest group including agriculture. It is, therefore, likely that today's farm problems will be solved only if macroeconomic policies that solve the problems of the whole economy can be devised.

The impact of macroeconomic policies may well raise a number of issues at the farm level as well. Policy actions to facilitate risk management by farmers and agribusinesses will take on much greater importance if the Federal government chooses to reduce farm price support and income transfer activities. Finally, if government funds allocated to farm programs are limited, there may be justification for discussing reallocation of those funds from price supports to market development and export credits. Each of these issues is quite complex but together they suggest a lively and highly important policy agenda for farmers over the next several years.

¹ Full employment of resources refers to a satisfactory rate of utilization of both capital and labor. It does not necessarily imply that all available resources are being used, however. For example most economists agree that between 4 and 7 percent of the labor force is normally unemployed even with full employment. This "frictional" or "natural" level of unemployment is due to people who have quit their last jobs to search for better ones and to individuals who are seeking their first jobs.

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IV. FOOD PROGRAMS AND POLICIES

- **Domestic Food and Nutrition Programs:
The Policy Issues**
- **Food Safety Issues for the Eighties:
Implications for Agriculture**

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Domestic Food & Nutrition Programs: Sorting Out the Policy Issues

*Food and Nutrition Service
U.S. Department of Agriculture*

THE FOOD AND NUTRITION SERVICE (FNS) operates 14 established food assistance programs. Three of these offer general food assistance to low-income Americans (the Food Stamp Program, The Food Distribution Program on Indian Reservations and the Trust Territories, and nutrition assistance for Puerto Rico and the Commonwealth of the Northern Marianas).

Eleven supplemental assistance programs address special needs and further specific national objectives by primarily providing benefits to low income participants: The National School Lunch Program, the School Breakfast Program, the Child Care Food Program, the Summer Food Service Program, the Special Milk Program, the Special Supplemental Food Program for Women, Infants and Children (WIC), the Commodity Supplemental Food Program (CSFP), the Elderly Feeding Program, Food Distribution to Charitable Institutions, Food Distribution to Summer Camps, and Commodity Distribution for Disaster Relief Efforts. FNS also operates the Temporary Emergency Food Assistance Program and a pilot Commodity Supplemental Food Program for the Elderly in three locations.

During Fiscal Year 1984, the total USDA support for these programs, including the cost of donated commodities and Federal program administration, was \$19.7 billion; Table 1 presents both program cost and participation data in 1980 and 1984. Total program cost was higher because other support was provided at the State and local level. Although not all participants in FNS programs are poor, nor do all the poor participate in FNS programs, this translates into expenditure of more than \$550 a year for every poor American. (There were 35.3 million Americans with incomes below the poverty line in 1983, the most recent year for which information is available). During Fiscal Year 1984, USDA subsidized in part or in full over 95 million meals a day, which comprise nearly 14 percent of all meals eaten in the U.S. each day.

Major Concerns

Three factors have engendered policy debate about

the Food and Nutrition Service programs in the past 5 years:

- The overall size of these programs—nearly \$55 million a day is disbursed in nutrition assistance;
- The rapid growth of the programs in the past decade—an increase of 69 percent after adjusting for inflation; and
- The recency of the majority of the program—nine programs were either created or implemented nationwide since the early 1970's.

Major policy changes have occurred in recent years. The Food Stamp Program received major restructuring in 1977. The Act as amended again in 1979 and 1980. A further 95 separate legislative changes were enacted in 1981 and 1982. The school programs also underwent legislative changes in 4 out of 6 years between 1976 and 1980. Review and debate of the programs continued by the executive and legislative branches of Government without specific legislative action. Finally, two major task forces—the President's Private Sector Survey on Cost Control (The Grace Commission), and the President's Task Force on Food Assistance also contributed to the policy debate on the goals and best design for nutrition programs.

The policy issues surrounding the programs involve five major questions about program design:

- 1) Who should be eligible or covered?
- 2) How should they be assisted?
- 3) How much should they receive?
- 4) What conditions must they meet to receive assistance?
- 5) How should the program be operated?

Food Stamp Program

The Food Stamp Program (FSP), currently operates in all 50 States, the District of Columbia, the Virgin Islands, and Guam. Eligible participants receive food stamp allotments based on their household size and net income after certain deductions.

Food stamps increase the food purchasing power of eligible households and thus enable them to attain a bet-

ter diet. The cost of the coupons is paid by the Federal Government. Current income eligibility limits and benefits are shown in Table 2.

The State social service agencies are responsible for certifying eligible households and issuing the food stamps. Authorized grocery stores accept the stamps as payment for food purchases, and forward them to commercial banks for cash or credit. The stamps flow through the banking system to the Federal Reserve Bank for redemption from a special account maintained by the Treasury.

In Fiscal Year 1984, an average of almost 21 million persons participated in the program monthly and received coupons worth an average of \$42.76 each month.

While the Food Stamp Program shares much in common with income maintenance programs whose benefits are used in determining a household's food stamp eligibility and benefit levels, it has several features that set it apart.

- The program is available to all who meet income and asset criteria. Participants do not have to belong to a specific category of the population to qualify for benefits.
- Benefits and eligibility rules are standard throughout the nation and based on a recipient's total income (minus allowable deductions), including public transfer payments. This has the effect of reducing discrepancies in income or purchasing power across regions due to wage differentials, or across States due to differences in other programs.
- The program is responsive to changes in circumstances and need. Eligibility can be determined and benefits paid within a matter of days for certain emergency cases. On average, eligibility and benefits are determined in less than a month, faster than any other Federal program by a significant margin. Further, in the long term, the program maintains the purchasing power of benefits through periodic cost-of-living adjustments to benefits and the various allowable deductions.
- Special provisions enhance benefits for groups with special needs, such as the elderly and disabled.

Since its nationwide implementation, the Food Stamp Program has grown rapidly. A significant turning point in participation occurred with the implementation of major legislative changes enacted in 1977 (the Food Stamp Act of 1977, P.L. 95-113). The most important of these was the elimination of the purchase requirement in January 1979 which increased the number of participants by almost 10 percent. Before the elimination of the purchase requirement, food stamp participants obtained stamps by exchanging cash for a predetermined allotment. Since the total face value of the stamps exceeded the cash payment, the participant received a net benefit in the form of the difference between these two amounts, known as the "bonus." After the elimination of the purchase requirement, participants began receiving only the bonus value in stamps and no longer had to make a cash payment. In the next

year, Fiscal Year 1980, the changes in the program coupled with an economic recession induced a close to 20-percent rise in the number of recipients.

Program cost almost doubled from 1975 to 1980, and real costs grew at an annual rate of 6 percent. Out of concern for this, legislation enacted in 1981 and 1982 was designed to curb program growth and tighten management. It retargeted program benefits to those with lower incomes; slowed the increase in benefit costs; restructured the Federal/State administrative relationship to bring about a reduction in error; reduced the potential for fraud, waste, and abuse in the program; and mandated specific administrative strategies and remedies.

Puerto Rico Nutrition Assistance Program (NAP)

A nutrition assistance block grant to Puerto Rico was authorized in Fiscal Year 1981 and implemented in Fiscal Year 1982 to replace the Food Stamp Program. The block grant allowed flexibility in providing nutrition benefits for the majority of Puerto Rico's population (56 percent) who had received food stamps.

The NAP eligibility criteria are similar to those in the Food Stamp Program. However, benefits are "cashed out," with NAP checks being freely negotiable for currency. Like food coupons, the checks are intended to increase food purchasing power of recipients.

The annual amount of the block grant as set by law, \$825 million, is used by the Commonwealth for both program and administrative costs. Puerto Rico may also use a small portion of the funds to finance its own projects for improving or stimulating agriculture, food production, and food distribution.

Child Nutrition Program

The National School Lunch and Child Nutrition Acts authorize a number of food service programs for children in schools and other institutional settings. These programs include the National School Lunch, School Breakfast, Child Care, and Summer Food Service Programs. The Acts also authorize funding to help States pay the administrative expenses associated with these programs, for a nutrition education and training program, and for nutrition studies and surveys.

Like the Food Stamp Program, the cost of the Child Nutrition Programs grew rapidly in the 1970's. From 1975 to 1980, spending in nominal dollars doubled from \$2 billion to \$4 billion. In 1981, legislation was enacted to curb program growth by targeting assistance to those most in need through reductions in upper income subsidies, tightening program management, streamlining administration, and offered remedies to reduce the potential for error in the program.

National School Lunch Program

The National School Lunch Program (NSLP) is the oldest and largest of the child nutrition programs. First authorized under the National School Lunch Act of

1946, the program provides Federal assistance to help schools and nonprofit residential child care institutions serve nutritious lunches to children.

Eligible schools and institutions include public schools of high school grade or under; nonprofit private schools of high school grade or under whose average yearly tuition does not exceed \$1500 per student; and nonprofit child care institutions such as orphanages, homes for retarded children, and temporary shelters for runaway children.

States receive both cash and commodities based on the number of meals served in the State at three different rates which vary according to the family income of the participating child. In addition States also receive bonus commodities which amounted to about 10 cents per meal (see Table 3). Children from families that meet certain income guidelines can qualify for free or reduced-price lunches.

Income eligibility for free meals is set at 130 percent of the Federal income poverty guidelines, and reduced-price meal eligibility is set at 185 percent. For the period July 1, 1984, to June 30, 1985, a child from a family of four with an income of \$13,260 or less would be eligible for free meals, and for reduced-price meals if the family income was no more than \$18,870. Students from families with incomes above 185 percent of the poverty line also receive Federal subsidies at 34 cents per lunch.

On an average school day in Fiscal Year 1984, 23.5 million children participated in the School Lunch Program. Of the total meals served, 44 percent of the meals were served free and 7 percent were served at reduced price.

A recent nationwide study on the School Lunch Program revealed that participants eat better than students who eat other sorts of lunches. The nutritional benefits of the School Lunch Program were observed for participants at every income level. Moreover, these lunchtime benefits were shown to actually enhance total daily food consumption of participants. The national study also revealed that, in general, participating families do not reduce their household food expenditures when their children receive Federal subsidies in the form of a school lunch.

School Breakfast Program

The School Breakfast Program was initially authorized as a 2-year pilot program under the Child Nutrition Act of 1966 and was made permanent in October 1975. Schools are reimbursed for each breakfast served at established free, reduced-price, and paid meal rates. School breakfasts were available to approximately 15 million children in schools and institutions in Fiscal Year 1984.

Summer Food Service Program

The Summer Food Service Program provides funds and/or commodities for food service for children during the summer vacation. Institutions eligible to par-

ticipate in this program are limited to those serving children from areas in which poor economic conditions exist. Furthermore, these institutions must be public or private nonprofit schools, other government organizations, or public or private nonprofit residential camps. Meals are served free to all participants and, except for summer camps and migrant programs, are limited to two meals a day—lunch and either breakfast or a supplement.

Over the course of the summer of 1984 an average of 1 million children were served.

Child Care Food Program

The Child Care Food Program provides funds for food service for children in child care centers and family and group day care homes. This is one of the more rapidly growing programs. Family day care participation has increased 240 percent between 1980 and 1984. In Fiscal Year 1984 about 1 million children participated in the Child Care Food Program.

Supplemental Food Programs

Two separate programs provide food assistance to low-income pregnant and postpartum women, infants, and preschool age children. The programs are the Special Supplemental Food Program for Women, Infants and Children (WIC) and the Commodity Supplemental Food Program (CSFP).

WIC Program

The WIC Program has grown from a \$20 million pilot project that began in 1974 to a program with an appropriation of \$1.3 billion for Fiscal Year 1984. The program is expected to serve 3.0 million participants by the end of Fiscal Year 1985 at a cost of \$1.4 billion.

All participants must meet eligibility standards based on income and nutritional risk. Currently, a maximum income of 185 percent of poverty is allowed. In Fiscal Year 1984 participation averaged approximately 3 million with an average cost of slightly more than \$39 per person per month.

Participants are individually assessed by health professionals, who prescribe appropriate supplemental food packages. The food packages are designed to provide foods that studies have demonstrated are lacking in the diets of the target population. The authorized supplemental foods are iron-fortified infant formula, infant cereal, milk, cheese, eggs, iron-fortified breakfast cereal, fruit or vegetable juice which contains vitamin C, dry beans and peas, and peanut butter.

There are three general types of delivery systems for WIC foods: 1) retail purchase in which participants exchange vouchers for supplemental foods at retail stores; 2) home delivery systems in which the prescribed food is delivered to the participant's home; and 3) direct distribution systems in which participants pick up the food from a storage facility. The food is free of charge to all participants.

Twenty percent of the total available funds (except for funds appropriated for program evaluation) are allocated among the States for administrative costs associated with the WIC Program. One-sixth of the administrative funds must be used for nutrition education activities.

Temporary Emergency Food Assistance Program (TEFAP)

In December 1981, the President announced that cheese, available in surplus inventory from dairy price-support purchases, would be distributed to needy households. The low-cost program grew rapidly, expanding to include other commodities such as butter, nonfat dry milk, honey, rice, flour, and cornmeal. The program provided \$1 billion worth of food assistance in each of Fiscal Years 1983 and 1984.

POLICY ISSUES

Just as domestic food programs cover a wide population with numerous forms of benefits and differing rules, they cover a wide range of policy issues.

Policymakers and analysts employ a generally agreed upon set of criteria for assessing the worth and impact of assistance policies and programs. The major criteria include whether: assistance is adequate; persons in like circumstances receive like benefits; those who need more receive more; the program reaches its target population; the program encourages self-sufficiency; program goals are achieved at minimum costs; and the degree of program clarity and simplicity.

Program policies, however, cannot meet all these criteria simultaneously. Trade-offs occur. Further, the relative importance of criteria can change over time.

Multiple Benefits

One major issue concerning how persons are assisted and how much they receive arises from the very number of programs offering assistance. Beyond the 14 domestic food programs there are programs for general welfare, housing, medical, energy assistance and education assistance. While each of these programs is designed to meet the needs of a particular population, there is no overall, well-integrated system.

A multiple program system raises two important issues for the domestic food programs. The programs are intended to provide access to a more adequate and nutritious diet for families and persons with low income and to promote the health and well-being of the nation's children. They are also intended to provide markets for surplus agricultural products. The first issue is to ensure an appropriate balance between the positive and negative aspects of multiple programs. This can be stated most simply as a question: Does participation in more than one nutrition program target benefits efficiently to recipients with special need or risk, or does it result in the provision of higher than adequate nutrition support?

The second issue relates solely to the Food Stamp Program but also involves the potential for the program providing more than adequate nutrition support. This problem creates inequities and program waste. The purpose of the program is to ensure the availability of resources to meet a household's food needs. The program is designed to count income from all sources and to supply a benefit which is the difference between 30 percent of net income (the percent of income a household is expected to use for food) and the amount of money required to purchase a minimally adequate diet (the Thrifty Food Plan or benefit guarantee). This design is intended to eliminate the problem of unintended or more than adequate benefits for households participating in more than one program. In the past decade, however, this program design has been seriously undermined by the growth of in-kind benefits, benefits which are not counted as income when the food stamp benefit is calculated.

Targeting Benefits

The Child Nutrition Programs are unusual in that all children, regardless of family income, can receive some Federal benefits. In most Child Nutrition Programs benefits are graduated, so that children from more affluent families receive lower subsidies than do poor children. Nonetheless, the Federal Government provides over \$500 million in subsidies to upper and middle income students in the School Lunch Program. In a time of limited Government resources, a major policy question for these programs is the extent to which the Federal Government should subsidize non-needy children.

For example, all children in family day care homes receive the equivalent of a federally subsidized free meal without regard for household income. Today, about two thirds of the children in day care homes have family incomes greater than 185 percent of the poverty line. The balance between program simplicity and program efficiency in delivering appropriate benefits has changed dramatically. Should graduated benefit levels be reimposed? An increase in administrative effort could reduce program cost and maintain benefits to the needy.

A second example is whether at a time when there is pressure to reduce overall Federal spending, any subsidy to upper income children should be provided. If these children can afford to pay more for their meals, should the Federal Government continue automatically provide them with assistance?

Program Integrity

Reducing error in program administration has only recently been a theme highlighted in the Child Nutrition Programs. In order to administer the programs at minimum cost, care must be taken that correct benefits reach participants.

A review in 1981 (by the USDA Office of the Inspec-

tor General) found errors in a substantial portion of applications for free and reduced price meals. Legislation was passed to change the application procedures and to allow verification of information on the applications. Subsequent studies have found a substantial reduction in the overpayment of child nutrition subsidies.

Federal and State Roles in Administration

Which level of government should be responsible for operating assistance programs? Proponents of local responsibility and control suggest that policy makers at the level of government closest to those served are in the best position to design and administer a program. On the other hand, there are those who feel that these issues are national problems and, therefore, have to be administered at the national level. Over time, the Federal Government has taken over responsibility for financing food assistance programs.

The issue of how best to ensure the efficient management of Federally funded, locally administered programs is an interesting example of the trade-offs in Federal-State relationships and roles. Since States do not share the cost of benefits, unlike other assistance programs such as Aid to Families with Dependent Children or Medicaid, the incentive they have to operate the program efficiently is somewhat diminished. There are several ways to increase the incentives, and the appropriate way or mix of ways to do this involves trade-offs in policy decisions. The basic methods are to 1) have States share in benefit costs; 2) set performance standards; 3) establish sanction systems; 4) establish incentive systems; and 5) mandate specific management or administrative procedures.

Performance standards set by the Federal Government for the States take two forms, sanctions for performance below acceptable standards and rewards for performance above established criteria. Sanctions for high rates of overpayments have been introduced as a way of providing incentive for States to determine eligibility and benefits with care. The Federal Government has also introduced a number of rewards to provide incentives for States to operate the Food Stamp Program efficiently. States with low error rates can have administrative costs matched at 60 percent to 40 percent Federal/State portions as opposed to equal contributions. States are permitted to retain a portion of overpayments recovered. Certain administrative efforts (e.g., fraud investigations, automation) receive 75 percent Federal funding.

The final way in which the Federal Government regulates State operation of the Food Stamp Program is by mandating certain management techniques. These techniques, such as monthly reporting and retrospective budgeting and wage matching are designed to encourage

efficiency by improving the quality or currency of information and by requiring enhanced verification of earned income, the largest source of errors.

Work Policy

While benefits provided should be adequate to meet the nutritional needs of program participants, the assistance should not encourage dependency among able-bodied recipients. These two objectives, however, are in conflict. The availability of assistance may reduce the need to work. The reduction of assistance to account for increased income reduces the reward from work effort.

Traditionally, Federal policy relied on economic incentives to motivate food stamp recipients to work. Conflicts among incentives, as illustrated above, do exist. As a result, any increased work effort may have to stem from work requirements.

In fashioning a work requirement policy there are three central questions:

- Of all food stamp recipients, which ones should be required to work as a condition of receiving assistance?
- What specific work should be required?
- How should a work program be implemented?

While it may be desirable to require all able-bodied recipients to work, it may not always be cost effective. Working to support oneself and family is an important value shared by most Americans, and activities that assist persons to accomplish this are judged good policy. This feeling was likewise expressed by food stamp recipients in studies that inquired about their attitudes on work experience.

The work policy issues just described are unlikely ever to be finally resolved. Policy will change with changing judgments concerning who is employable, what services they require, magnitude of likely benefits and costs, and the feasibility of various Federal/State funding and administrative arrangements.

Conclusions

Central among the issues regarding food assistance are:

- Who should be eligible for aid?
- How should they be assisted?
- How much should they receive?
- What conditions must they meet to receive assistance?
- How should the programs be operated?

The resolution of each of these issues, as discussed, involves making difficult trade-offs between what may appear to be equally desirable goals. Ultimately, difficult decisions are value judgments.

Table 1
FNS/USDA Food Assistance Programs
Fiscal Year Data

	<i>COST</i>			<i>PARTICIPATION (FY AVG)</i>		
	<i>1980</i> <i>Mil. Dollars</i>	<i>1984*</i>	<i>Change</i> <i>Percent</i>	<i>1980</i> <i>Mil. Persons</i>	<i>1984*</i>	<i>Change</i> <i>Percent</i>
Food Stamp	8,286	11,604	40	19.2	20.9	9
Puerto Rico Nutrition Assistance Program	853	825	-3	1.9	1.6	-16
Child Nutrition (includes commodities)	4,037	4,282	6			
National School Lunch	3,187	3,338	5	26.6	23.5	-12
School Breakfast	288	372	29	3.6	3.4	-6
Child Care Food	239	409	71	.7	1.0	49
Summer Food Service**	118	109	-8	1.9	1.6	-16
Special Milk	145	17	-88	10.0	1.0	-90
Nutrition Ed. & Studies	22	7	-68			
SAE	38	43	13			
Special Supplemental Food						
Women, Infants & Children (WIC)	708	1,386	96	1.9	3.0	61
Commodity Supplemental	21	46	119	.10	.14	39
Commodity-Specific Programs						
Nutrition Prog. for the Elderly	75	126	68	.70	.82	14
Food Dist. on Indian Reserv.	28	58	107	.07	.11	63
Charitable Institutions, Summer Caps, Disaster Relief	71	195	175	.09	2.2	2,344
Special Food Distribution	—	1,091	—	—	10	—
Food Program Adm.	84	83	-1	N/A	N/A	N/A
Total	\$14,163	\$19,709	39	Not added due to caseload overlap.		

*Preliminary data.

**Peak Participation.

Table 2
Food Stamp Program:
Maximum Benefits and Income Eligibility Limits

<i>Household Size</i>	<i>Maximum Monthly Food Stamp Benefit¹</i>	<i>Income Eligibility Limits²</i>			
		<i>Net Income (100% poverty)</i>		<i>Gross Income (130% poverty)</i>	
		<i>Monthly</i>	<i>Annual</i>	<i>Monthly</i>	<i>Annual</i>
1	\$ 79	\$145	\$4,980	\$189	\$6,474
2	145	560	6,720	728	8,736
3	208	705	8,460	717	10,996
4	264	850	10,200	1,105	13,260
5	313	995	11,940	1,294	15,522
6	376	1,140	13,680	1,482	17,784
7	416	1,285	15,420	1,671	20,046
8	475	1,430	17,160	1,859	22,308
Each Additional Member add:	+ 59	+ 145	+ 1,740	+ 189	+ 2,262

¹Effective November 1, 1984, to September 30, 1985.

²Effective July 1, 1984, June 30, 1985.

Table 3
NSLP Subsidy Levels
(in dollars)

	<i>Fiscal Year 1985</i>		
	<i>Free</i>	<i>Reduced Price</i>	<i>Paid</i>
Annual Family Income (for a family of four)	0-\$13,260	\$13,260-\$18,870	over \$18,870
Entitlement			
Cash	\$1.255	0.855	0.120
Commodities	0.120	0.120	0.120
Bonus	0.100	0.100	0.100
Total	\$1.475	1.075	0.340

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Food Safety Issues for the Eighties: Their Implications for Agriculture

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AS CONSUMERS, FARMERS, food processors, and food technology innovators try to modify food system rules to reflect their own particular interests, the performance record of the U.S. food safety system is once again under scrutiny.

What are the current criticisms of the food safety system? Who are the major players in the game and what are their interests? Where are the current winds of change likely to lead? What legislation or policies being considered could lead to differences in the safety, nutritional value, availability, or cost of our food? What will be the future impact of the "food safety system" on consumer satisfaction, food industry well-being, and on the progressiveness and competitiveness of the food system?

Consumers

Consumers make up the largest group of participants in the food market and they are concerned about food safety. Today's consumers are better educated than previous ones and more aware of many diverse health hazards associated with the way foods are produced, processed, and marketed as well as hazards from mis-handling in the home. They increasingly associate diet and nutrition with personal health status. Yet lifestyles have changed. Smaller households are now common as well as working mothers and singles, and people have higher incomes to spend on food. This has increased the demand for more convenient-to-prepare foods with greater sensory appeal. At the same time these foods may be the source of additional health risks, exposing consumers to chemical additives needed to enhance preservation and increase appeal and to other contaminants added unintentionally.

Major Concerns

Over the years, attitudinal surveys about food safety have revealed that consumers are concerned primarily about: (1) obtaining more protection from food hazards, (2) information about food safety hazards, (3) education and training on safe food handling and

choice, (4) who should provide food safety protection and information, and (5) who should pay additional costs.

Protection from Hazards

Consumers' desires for **more protection** relate directly to their reluctance to be exposed to food-borne hazards. Individuals differ sharply in their attitudes—some show virtually no concern over food safety while some exhibit extreme concern. A 1984 national survey of 1,008 American consumers by the Food Marketing Institute (FMI) indicates that a large cross-section of them fears that some of the chemicals used in the production, processing, and preservation of foods are not safe. Approximately half of all respondents to the FMI survey said they believe some additives to processed foods may be unsafe to eat. What is more, they said they avoid buying products they believe to be risky. Substances specifically mentioned where chemical flavorings (by 25 percent of respondents), preservatives (17 percent), sugar (22 percent), and salt (17 percent). The presence of microorganisms known to spoil foods was indicated as a concern by 12 percent of the respondents and harmful disease-causing agents by 6 percent. However, 77 percent of the respondents said that pesticide and herbicide residues in food are a serious health hazard compared to 32 percent who mentioned food additives and preservatives and 26 percent who named coloring agents.

The FMI survey results also suggest that some consumers want foods offering more protection from possible hazards than is provided by current law. Consequently there may be an extensive market for foods produced and processed by what many may regard as unconventional technologies. Examples found in the marketplace include "natural" foods: foods produced without the use of pesticides, animal drugs, or chemical fertilizers, or foods processed without preservatives or other food additives. Other markets exist for new formulations of foods with reduced or extremely low amounts of specific additives such as sugar, salt, or other ingredients suspected of contributing to certain diseases. On the other hand, some consumers appear to

Eileen van Ravenswaay and James D. Shaffer, Michigan State University, contributed reviews of the paper. This is one of a larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

want foods enriched with nutrients believed to have beneficial properties. Finally, some consumers want more stringent sanitation standards and increased use of tamperproof packaging.

While these consumers appear to be willing to pay for increased food protection services, others would rather sacrifice some safety if it means lower prices. In recent years, the return of bulk product merchandising has catered to those consumers who are willing to sacrifice a little safety and product information for the opportunity to pay lower unit prices and reduce their expenditures for food. While these consumers probably don't equate bulk merchandise products with safety problems, they do sacrifice specific product information.

Information

Directly related to the concern about more protection services is a desire for **more food safety information**. The recent FMI survey showed a sharp increase in consumer self-reliance to determine the safety of food. However, for a consumer to really make valid food safety judgements, he or she must have considerable information about potential problems and their seriousness. In practice, the provision of sufficient information is very problematic. Oftentimes those reporting food safety news don't have the scientific expertise to put issues or problems in perspective.

Consumers seem to want two major types of food safety information. One type is purely **descriptive generic information** about the food product itself. Consumers already have decided, correctly or incorrectly, that some product characteristics are either good or bad. They simply want to base their purchase decisions upon the presence or absence of some component or processing technology in a product. Examples include: macro and micronutrient composition, chemical substances used to produce the food commodity, processing technology used, and type of packaging material.

The second type of information requested is for a **professional safety judgement**. An example is a warning statement on the label stating that consumption of the item could cause some illness or disease. Currently soft drinks sweetened with saccharin must carry the warning: "Use of this product may be hazardous to your health. This product contains saccharin which has been determined to cause cancer in laboratory animals." The consumers are confronted with an unquantified probability of this hazard and left to choose whether or not to purchase the product depending upon their perception of the risk involved. No other label information is given to consumers about this or other possible hazards associated with the many other substances that might be legally contained in this food product or others that would be consumed with it. Concentrating attention on one important risk eliminates an information overload problem which may occur when many ingredients and nutrients with their respective warnings of use are listed

on labels. However, it is important to realize that the selective use of warning labels relies upon a regulatory process of some type to identify and quantify important hazards and make professional judgements about them.

If consumers are to make beneficial use of more information, a major **continuing consumer information program** will be required. Consumers must not only be informed of new knowledge about food hazards, but also of how to assess the risk involved and to keep it in proper perspective. At the same time, the food safety program must be able to respond quickly to major consumer concerns as they develop.

Providing and Paying for Services

As to **who should provide for added protection or more information and who should pay for it**, consumers appear to be willing to pay some increased prices for these services. But no research results demonstrate that consumer willingness to pay would be commensurate with the costs of providing them through the marketplace. Nor are there any studies that show that consumers can select priorities in their preferences for safety services according to the realizable benefits. Consequently, consumers' uncertainty about the benefits and costs of additional services results in different opinions about who should provide more food safety services. Some strongly feel that the federal government should be the chief guarantor of consumer protection and information, but others feel that the food industry should take more responsibility and provide more safety services and information. In sum, the marketplace offers an advantage of determining which services will be purchased in quantities sufficient to cover private costs. However, government will continue to have a legitimate vote in ensuring an equitable distribution of essential safety services to consumers as well as in providing additional protection when it appears the additional benefits to society outweigh the costs involved. Redistributing these services or costs and providing new services will probably require the enactment of new legislation.

The Food Industry

The structure of the U.S. food system has changed dramatically during the past 30 years. The number of farms and marketing firms has shrunk, while those remaining have grown in size and sometimes in market share. Firms have focused on goals of growth, profits, efficiency, and market control. New production, processing, and marketing techniques that enhance product appeal to consumers or reduce costs have been readily adopted. Yet food producers and processors have found that many of the technologies used to produce the products that consumers want to buy are the same technologies that draw safety-conscious consumers' fire, namely the use of chemical processes and additives, animal drugs and stimulants.

Although growth, profits, and efficiency have been food industry priorities, food firms have also become more conscious of the need to produce safe products. Most firms have developed, promoted, and built their reputations and future profit potentials on lines of branded products which consumers can readily identify and with which they feel comfortable. Adverse publicity about the safety or quality of a product or a firm's unwillingness to comply with safety rules and regulations can bring instant losses in good will, sales, and profits that could take years of advertising and promotion expenses to recoup. In addition, product liability lawsuits can result in mammoth legal bills.

Safety Standards

Numerous government safety standards apply to these firms. Some specify the processes used to produce a food product (process standards); others specify the purity or composition of the final product (performance standards). Examples of the former include good manufacturing practices and the use of approved equipment or packaging materials. Examples of the latter include product standards of identity and composition and tolerance levels for pesticide and animal drug residues and environmental contaminants.

Enacting food safety laws, promulgating rules, and establishing public agencies to inspect food and plants and enforce rules have removed much of the opportunity, risk, and uncertainty that firms would encounter in the marketplace if they were left on their own to develop acceptable safety standards and compliance procedures by which to compete with one another. Food safety regulations establish a floor below which food safety performance cannot fall, even performance by unscrupulous, inefficient, or low resource firms. These regulations protect unaware or uneducated consumers when they are properly enforced. However, food safety regulators' tendency to rely on process rules rather than performance standards discourages competition on product safety or innovation in the area of safety-producing technology.

Regulatory Issues

The food industry has alleged that the regulatory environment imposes unnecessary and costly burdens and that it is too inflexible to achieve the progress demanded in the domestic food market. Specific issues frequently cited include: (1) the need for legislative relaxation of the anticancer Delaney clause, (2) the need for a new legislative definition of safety that incorporates a recognition of risk, (3) use of risk/benefit or cost/benefit concepts in determining whether to approve or deny use of regulated substances and processes, (4) more reliance on outside experts in the food safety process, (5) setting strict time periods in which food safety regulators have to render decisions on petitions, (6)

reducing paperwork requirements, and (7) relaxing continuous inspection procedures for federally inspected meat and poultry product processing establishments.

Costs

The food industry has not been an ardent supporter of consumers' demands for more food safety services for several reasons. First, there is little incentive for a firm to adopt cost increasing measures except to differentiate a product and obtain either higher prices or greater sales than the competition. In many cases, the benefits of cost-increasing services cannot be appropriated by any one firm. Competitors cannot be prohibited from emulating these services, and there is little opportunity to recover development costs. This is especially true for presenting public information about food in brochures or label formats and quality measures derived at considerable expense to the originating firm—for example, shelf life or freshness dates printed on packages. Competitors can easily read and interpret this information and copy it with no fear of reprisal and at no cost for the experimentation leading to the information. The initiator cannot expect to recover the investment needed to produce the service. Today, in addition, the high cost of capital acts as a further deterrent to any firm that might wish to provide the information as a means of promoting good will.

Secondly, no comprehensive market research results available from the public or the private sectors indicate the extent of the market for many of the new food safety services proposed by consumers. Firms will have to engage in expensive and time consuming experimentation to determine what the demand is for new services.

Marketing Problems

Food firms remain concerned about an age old marketing problem: the absence of safety standards upon which to establish commodity prices that would reflect the expected processing cost to make the commodity safe for a food use. When it comes to safety, imperfect information affects all participants in the food system. All too frequently, potential hazards such as chemical residues and microbial pathogens are neither visible nor readily detectable and are sold to unsuspecting buyers. Ownership identity is frequently lost during marketing as commodities and ingredients are assembled or blended into new lots for resale. Once the hazard is discovered, the owner may attempt to minimize his loss by spreading it over future sales transactions through small offsetting price adjustments. The party responsible for the loss may remain undetermined and may never pay any more than a small fraction of the loss.

Lack of assurance about the safety of commodities sold in the marketplace encourages food firms to vertically coordinate production and marketing stages.

Then a firm can impose safety performance and process standards upon its departments as well as monitor for compliance at each step in the process. Furthermore, larger firms can capture any compliance scale and pecuniary economies that might result from applying new, more efficient hazard detection techniques applicable to large volume operations. High investment and operating costs might prevent smaller firms from owning or leasing such systems, thus leaving them exposed to the potential economic losses from the use and sale of less safe inputs and products.

Potential Misuse of Drugs and Chemicals

Major economic losses can result when producers do not know the characteristics of, and remedial measures for, misuse of potentially hazardous substances. Once a problem is recognized, finding the information on corrective measures may be too time consuming to prevent catastrophic losses. Some producers, at considerable risk to their business reputations, might be tempted to market contaminated commodities and ingredients in order to transfer any expected economic losses to an unsuspecting buyer.

An example of this dilemma is the use of available but unapproved drugs to promote livestock growth or treat animals. There are no assurances that drugs used for nonapproved purposes are safe or effective. Potentially serious losses to producers, processors, or consumers could result. Yet for many of these substances, detection methods have not been developed. Preventing the introduction and sales of these potentially hazardous substances, developing simple, inexpensive detection methods, and educating farmers, processors, and food handlers about the possible consequences is a new dimension of an ongoing problem. At the same time, producers throughout the food system must become increasingly convinced of the need for good management systems for handling potentially hazardous chemical technology and capable of implementing them. As a first step, the Federal Extension Service, in cooperation with state extension specialists, is conducting a national program to educate livestock and poultry producers and handlers about chemical and drug residues and their prevention.

Innovators

Technological innovations increase productivity, output, and progress in the food delivery system. Innovation may occur at any level: input supply, farm, processing, transportation, or distribution. In the same way, innovations at any level may have food safety implications. Some of the most important cost reducing innovations of the last several decades include the development of a number of pesticides, food additives, animal drugs, and packaging materials. Also important or promising for the future are: vacuum packing, ultra-

high temperature processing, mechanical deboning, irradiation, microwave cookery, and genetically engineered drugs, additives, and stimulants, to name only a few of the new processes.

The innovators of many of these substances and processes, chemical and pharmaceutical firms, are concerned that too many costly licensing and registration approval procedures discourage the rapid development of new innovations. In the past, these innovations have helped the United States maintain its present technological lead in food production and marketing, a lead being challenged by Japan and other countries which are pursuing advancements in biotechnology. Cumbersome regulatory procedures are also viewed as impeding the introduction of safer substances that could replace more hazardous, less efficacious substances now in use.

Regulations

Food innovators have three major concerns about the U.S. regulatory environment. (1) Animal drug, food additive, and pesticide registration procedures are too complex and unnecessarily time consuming for industry and for regulators. (2) Too much time and money must be spent on defensive research to reconfirm the safety of previously approved substances. Scarce research and development funds must be redirected away from developing new products. (3) The patent protection term of 17 years is too short to provide firms the necessary incentives to invest in the costly development and approval of many needed substances.

These arguments can be supported with evidence. Rates of approval for new substances dropped rapidly during the past decade: from 4.2 new animal drugs per year during the 1967-1971 period to an average of 1 per year during the 1976-1979 period. Approval times increased. The average time required for the approval of a food additive increased from 2 to 4 years and up to 10 years. The average time for pesticide approval was 2 to 3 years, ranging up to 6 years.

The Reagan administration took steps to cut time requirements by introducing "fast-track" approval procedures. However, innovating firms had already started to relocate research and development operations overseas. A U.S. pharmaceutical manufacturers survey showed that 20 percent of the research was done abroad in 1979 compared to 10 percent a decade before. Other companies are getting out of the research area altogether because of the unfavorable outlook. Furthermore, food industries in many foreign countries can obtain nationally approved substances far in advance of their approval by U.S. regulatory agencies. For example, between 1970 and 1980, the European Economic Community (EEC) approved 24 new animal drugs that were not made available in the United States during the same period. Furthermore, EEC approval times for some substances are only half those of the U.S. Molecular

biologists are expected to produce many new substances for expanding food output and lowering production costs during the next decade. Continued faster approval of the use of such substances by foreign countries could seriously erode the United States' ability to produce efficiently at home and to compete effectively in international markets. The bottom line could be a smaller share of world markets for U.S. food products.

The registration process can evoke many time consuming, if not insurmountable, problems. Insufficient technical information to assure safety may be provided by the petitioner, or the regulator may be uncertain about what information to request. Sometimes the scientific issues are so complex that professional differences in the opinions of petitioner and reviewer require additional technical information or withdrawal of the petition altogether. The lack of specific procedures to follow for testing and analyzing substances for safety is a frequent source of difficulties. Yet there is no single set of procedures that apply, or possible should apply, to safety testing for all pesticides, animal drugs, additives, or other substances such as packaging materials.

New Testing Procedures

Advancements in bioassay procedures to test for safety have been as dramatic as developments in food production technology. It is now possible to detect the presence of some contaminants at concentrations of parts per billion or trillion. Many substances still in use were approved years ago by far less sophisticated assay techniques. In 1979, the Food and Drug Administration proposed procedures to test all new and old animal drugs for carcinogenicity. However, the proposal was judged excessively costly. The carcinogenicity tests for some old drugs might exceed their total annual revenue by one or more times, probably forcing their withdrawal from the market. Producers relying on the use of these compounds might need to make cost increasing production adjustments to compensate for the loss of withdrawn substances. And committing scarce research funds to keep products without any evident adverse effects on the market might slow the development of new products. Recently, the FDA offered a revised proposal that substantially modifies the earlier one. This new proposal, entitled "Human Food Safety," omits any mention of testing old drugs for carcinogenicity but does revise requirements for testing new drugs. This new version might extend the market life of some old compounds not currently suspected of being cancer-causing agents.

The capability to detect infinitesimal concentrations of potentially hazardous substances in food has stimulated interest in amending the anti-cancer Delaney clause of the Food, Drug and Cosmetic Act. In 1958, the year of enactment, the zero tolerance feature of the Delaney clause was defensible because the best assay

method lacked the sophistication to detect small amounts of cancer-causing substances. But advancements in assay technology that enable laboratory technicians to detect minute, and what many consider harmless, quantities of these substances support the adoption of a non-zero tolerance. Such a tolerance would enable the approval of foods and additives currently prohibited by Delaney. The policy problem is trying to determine a socially acceptable and scientifically supportable risk level. However, little of the evidence which has been presented on the socioeconomic benefits and opportunities for agriculture would support amending Delaney.

Many of these issues have been addressed recently in proposed legislation to amend the Food, Drug and Cosmetic Act. But the controversy over how to effectively increase efficiency without sacrificing safety has stalled enactment.

Patent Protection

Controversy over the inadequate length of the patent protection term originates with the protracted delays experienced by petitioners who try to obtain registration approval for pesticides, animal drugs, and food additives from regulatory agencies. An innovator sometimes obtains a patent only to find that he or she may not be granted a registration petition to sell the product for several years. The innovator is not granted any adjustment for the portion of the 17 year protection term used for obtaining registration approval. Recovery of a usually substantial investment must be made in whatever time is left. The Congress recently enacted legislation to extend patent terms for certain additives and pharmaceuticals but failed to enact companion legislation for animal drugs and chemicals.

Extending the patent protection term for substances that might need to be reviewed periodically with up-to-date procedures to verify their safety could provide the private sector with one incentive to test a product instead of withdrawing it from the market. A guarantee of an extended protection term would improve a firm's ability to recover its testing costs without fear of early competition from price-cutting competitors. Once the patent expires, these competitors can replicate the product without bearing any of the research and development costs.

Regulators

Concerns about the need to improve the performance of the federal food safety regulatory system have been well publicized. Registration procedures need to be simplified and the petition review process made more efficient. Duplication of effort among federal food safety regulators and between federal-state agencies needs to be eliminated and any gaps and omissions filled. The safety criteria need to be made explicit and consistent

with knowledge about present day problems and up-to-date state-of-the-art production techniques. There is little interest in grouping responsibility for food safety, currently spread over several agencies, under a super agency that would regulate all aspects of food safety at the federal level.

Many current procedural matters can be corrected by promulgating amendments to existing regulations. However, other safety issues would require congressional attention. One is the future role of the federal government in food safety regulation.

Self-Regulation

Should industry representatives be entrusted to develop codes of conduct and enforce those codes among themselves with government guidance in determining the goals and defining acceptable conduct limits? If so, the private sector might display considerable imagination and initiative in modernizing methods and procedures to protect consumers from unsafe foods, and at the same time offer consumers greater choice in food safety services. If the supply and demand for safety services were determined in the marketplace, a large part of the economic cost now borne by the public sector could be shifted to the private one. Industry trade associations could establish quality control and compliance procedures to ensure safety, conduct ongoing research to develop new and more cost effective bioassay and toxicological testing procedures, and develop informational programs and materials for industry use as well as that of consumers and producers.

An economic advantage of trade group sponsorship is the realization of research and development scale economies that are not available to the individual member firms. Results would be made available to all members at a relatively low cost compared to that of each firm conducting its own research program. Costs could be allocated to members by any one of several methods including fixed fee or on a dollar sales volume basis. Enforcing codes might require nothing more than an industry trade group denying a violator access to services and publicizing the name of the violators and the violations. In other cases, such as establishing food safety standards and punishing criminals for other serious violations, the public will likely continue to want the federal government strongly committed and involved. It does seem increasingly desirable, however, to foster, whenever productive, a cooperative, progressive relationship between government and industry. Antagonistic, litigation-prone interactions are time consuming, expensive, and in the end nonproductive. Modifying the safety regulatory system to encourage the industry to do the things it does well, such as developing a consensus and acting rapidly when it is motivated, might resolve many of the industry's complaints that a bureaucracy does not provide service as quickly or ef-

fectively as a private organization. The key to the success of a policy based on industry self-regulation is convincing the food industry that acting in the "public" interest is in the industry's interest. However, previously enacted antitrust legislation will need to be amended to allow more cooperation between firms in a given food industry. Such firms can then conduct research jointly and set up self-policing programs.

Inspection—Benefits and Costs

Who should pay the cost of daily food inspection, especially the \$325 million a year for federal meat and poultry inspection? This concern is another controversial issue. The taxpayers now bear most of this expense. Legislative and regulatory proposals to transfer cost to regulated firms in the form of user fees have met with strong opposition, although the cost burden does not appear excessive. Arguments against the proposals include the inability to establish a system equitable to both small and large processors in terms of its availability, quality, and the cost of such a service. Furthermore, part of the cost would be shifted to commodity producers who are not necessarily able to pay. Shifting the cost to firms might induce some to cheat or otherwise cut corners to cut the cost of the service. This then raises new enforcement problems.

Policymakers and regulatory agencies are concerned about determining the optimum level of enforcement. Too little enforcement can result in numerous violations and huge losses to society. But too much enforcement can result in the last dollar spent on protection producing only a fraction of a dollar of safety protection benefits. Unfortunately, virtually no empirical evidence about the losses associated with different levels of enforcement expenditure is available. It is not technically or economically possible to eliminate all forms of food safety risk. Society needs to establish some reasonable goals and let the regulatory agencies develop cost effective measures that would bring marginal costs in line with marginal social benefits.

Need for International Coordination

The increased internationalization of the food market reveals dramatic inconsistencies in food safety standards and enforcement between countries. Differences in public attitudes about food safety needs and about protecting national agricultural economies from imports form the bases for the variations in policies. Countries are understandably reluctant to give up jurisdiction over food safety to an international organization which may or may not adequately reflect national interests. Such an organization could be very useful, however, providing uniform rules and compliance and enforcement procedures; generating and disseminating information worldwide on how to produce, process, and assay foods for safety; educating inspection personnel about accepted

techniques; and sponsoring or conducting research on cost effective inspection methods. An organization of this sort could establish a system that would monitor the occurrence of hazardous incidents involving food; provide assistance, especially to developing countries; and alert countries to problems needing immediate attention. Organization costs could be borne by member countries based on ability to pay or on the value of their commercial food sales. Such an organization would offer member countries substantial savings on large scale research on food safety problems and on developing compliance and enforcement methods. It would also facilitate international trade and assist many developing countries in establishing their own organizations to promote food safety.

At present, the Codex Alimentarius Commission of the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) develops international standards and safety practices for foods through negotiations with 122 member countries. The Codex standards include minimum safety and hygiene levels that countries may apply voluntarily as well as ingredient and label information. Although the Commission has existed since 1962 and has developed numerous standards, member countries, especially developed countries, have been slow to adopt these standards. Until they are more widely adopted, international trade is likely to remain impeded by inconsistent standards. Because safety standards are a convenient form of non-tariff barrier for countries wishing to protect markets, commitment to free trade as well as a consensus about food safety criteria will be important if discrepancies in standards are to be resolved.

Implications for U.S. Agriculture

What do all these food safety issues mean for the U.S. producer? The food industry already possesses many of the technical and administrative methods to provide the safety services wanted by U.S. consumers and our trading partners. Admittedly the flexibility of existing services is limited. This presents three not altogether new implications for producers of raw food commodities.

First, the food industry cannot provide all necessary safety services in a cost effective manner and continue to meet expectations for high quality, variety, and economy without substantially closer cooperation and coordination with the commodity producers. In order to satisfy more and increasingly technical safety specifications, producers will need to alter their production and management practices. Since open markets do not operate efficiently to determine price when a large number of commodity classes and safety specifications are involved, more contract production or vertical coordination is likely. The need to resolve long-standing issues increases—these issues include freedom of entry, especially to foreign food markets, and necessary condi-

tions for the survival of the traditional family farm structure.

Secondly, producers need more technical services to make the adjustments that will be required in the new market environment. The needs are many, including: (1) establishment of new transaction standards based on the presence or the lack of health hazards in or on the food commodity, (2) new production methods that protect the commodity from the hazards, (3) new management information systems to record the production history of a commodity and verify compliance with safety standards, (4) up-to-date information on proper handling and use of hazardous substances in the production process, and (5) information on penalties levied by the enforcement agency for noncompliance.

Thirdly, producers need economic protection from a number of potentially threatening factors. These include less control over the production decision making process, fewer marketing opportunities, and increased exposure to product liability claims. Protection needs include: (1) an arbitration system that affords quick, inexpensive, equitable settlement of legal disputes between producers and buyers, or between producers and input suppliers over safety compliance problems; (2) stronger enforcement measures to reduce the availability of illegal, potentially hazardous substances that could cause serious economic losses to producers who unwittingly use them; (3) methods to enable producers to verify quickly and easily the purity of purchased inputs and commodities from common contaminants; (4) a nationwide information system to track ownership of food animals and shipments of food crops from the farm through the processing stage; (5) implementation of a program to discourage misuse of potentially hazardous substances that could result in compliance violations; (6) readily available information on corrective measures to minimize losses from accidents involving dangerous substances, disposal of hazardous wastes, and contaminated commodities; and (7) readily available current information on substances and practices approved by the United States and other countries for use in producing food.

Policy Consideration

Achieving the goal of increased food safety to satisfy domestic and international market needs will require both public and private sector involvement. Government involvement should complement the actions of the private sector. Government should be active in sponsoring basic research and developing applied techniques in situations where an uncoordinated private sector approach would lead to duplicated efforts, excessive costs, and a high probability of failure in successfully completing the research. Public policies to fulfill informational and educational needs are appropriate for the same reasons. Given the rapid changes in technology,

new definitions of safety and new standards and enforcement strategies should be developed, debated, and adopted by public policymakers in order to achieve socially desired levels of compliance. Protection of producer well being and the need for extended patent protection also should be resolved by public policymakers because of the numerous legal issues involved. In addition, diplomatic protocol will probably continue to require extensive public involvement in negotiating and approving international definitions of safety and compliance standards for food and commodities sold in international markets.

What about consumers? What does the evolving food system mean for their convenience, nourishment, and satisfaction? It is likely that the U.S. food supply, already one of the safest and most abundant in the world, will become more so. It is likely that consumers will have more food safety choices in the market and will have to make more decisions between safety and food costs. It is also likely that the amount of safety-related information available to consumers will continue to grow. To be valuable to consumers, this information must be factual and free of the sensationalism that often characterizes stories on food safety problems. Consumers of all ages will require intensive education on hazards, their consequences, and how to prevent them. Many of the most common and the most serious food safety hazards are found in the home. Finally, consumers need to understand and accept the principle that it is not possible, either technically or economically, to eliminate all risk from the food system. Rather, the food safety system acts best when it spends limited resources on the most serious problems.

The private sector can, and probably will, play a leading role in developing consensus on a number of safety issues to be dealt with by public policymakers. Furthermore, much of the market development and application of compliance methods will remain with the private sector, following sponsorship or completion of the basic research by the public sector. The private sec-

tor will continue to have a leading role in determining the structural arrangements by which producers and the food industry will coordinate production and food safety protection. And within the constraints imposed by public regulation, the private sector will test the market potential for additional services. Such services will determine future courses of action for both public and private involvement in establishing new food safety policies and programs.

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V. RESOURCES AND CONSERVATION

- **Natural Resources and the Food System:
An Overview**
- **Soil Conservation Policy for the Future**

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Natural Resources and the Food System: An Overview

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NO ONE QUESTIONS the fact that the U.S. food system depends on natural resources. In a very real sense, food *is* natural resources—the conversion of nutrients, air, and water into a product that people consume to sustain themselves. Agriculture is the controlled conversion of resources into products. The “food system” is the process of getting these converted resources to consumers.

The facts of the conversion process are known (or at least knowable). The resource combinations used in producing, processing, shipping, selling, consuming, and disposing of the residue of the food system are generally understood. We have plenty of data on resource supplies and their current use. But we disagree profoundly on the “so what” questions, particularly those concerning the impacts of resources/food on future generations. The basic questions: will there be *enough* food for the future? Too much? Will we run out of good farm land? Are we stifling development with overzealous conservation programs? Are we “fouling our nest” with the residue of resources—sediment, toxic pesticides, nutrients in the water supply? Will high tech agriculture lead to crops that are more vulnerable to disease, reduce genetic diversity, exhaust energy supplies, compact the soil, reduce food quality? Or will these substitutions of capital for land and labor continue to generate more food per acre, increase product choices for consumers, and generally improve living conditions around the world? The answer to these questions is an unequivocal “Maybe.”

Experts disagree:

The Global 2000 Report to the President — “Serious deterioration of agricultural soils will occur worldwide, due to erosion, loss of organic matter, desertification, salinization, waterlogging. An area . . . the size of Maine is becoming a wasteland each year . . . [in the world].

Food production [in 2000] will be more vulnerable to disruptions of fossil fuel supply and weather fluctuations as cultivation expands to marginal areas.”

Resource Economist Michael Brewer — “Such [farmland preservation] programs could be difficult, costly, and disruptive to local and regional economies.”

Economist Julian Simon — “The key idea is that land is man-made, just as are other inputs to farm production. With the development of modern farming methods, the output of a piece of land depends increasingly little on its natural endowments.”

Lester Brown, Worldwatch Institute — “The world is moving from a situation of chronic excess of agricultural production capacity to one of chronic scarcity.”

There are of course many more “experts.” The key point is that the same basic data support these divergent views of the future. Various experts make judgements about future possibilities and what government should do about them based on ill-defined mixtures of selective fact, fears, reactions to risk and uncertainty, and such elements of self-interest as the short term rewards of selling books. Governments act in response to pressure from resource users to alter the economic signals facing them. The purpose of such government actions is to *change* future patterns of resource use, absorb risk, and avoid problems.

The purpose of this paper and several to follow is to clarify the many interactions between natural resources and the food system and related policy choices. Policies frequently focus on one defined resource problem like erosion or water scarcity, thus missing the complex interactions *among* resources and among the parts of the food system. Our goal in these papers is to improve the chances that the food system policies of the future can be sensitive to the ways in which resources are being used at the same time that they reduce uncertainty about future resource scarcity. Natural resources are both inputs to, and outputs of, the U.S. food system.

Natural Resources as Inputs to the Food System

Soil, water, air, nutrients and energy interact in the production, processing, and selling of food. A few examples:

- a farmer needs access to soil and water in a quantity and quality appropriate for growing things that people will pay for.
- solar energy is the essential ingredient of plant

Philip M. Raup, University of Minnesota, and A. Allan Schmid, Michigan State University, contributed reviews of the paper. This is one of a larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

growth. Chemical fertilizers and pesticides are energy-intensive. Fossil fuels move food to consumers.

- water is a major transport medium for the food system. Grain moves to export on the Great Lakes and river system of the nation.
- air contains the essential gases for plant growth. It is a transport medium and a source of energy for drying, pumping, and other production needs.

The Policy Problems

Policy actions create access to resources as inputs to the food system and establish rights and obligations for competing users of these resources. *Who* should have access rights, for what, at whose expense, and how these rights should be secured become the substance of natural resource policy. Selections among policy options influence the performance of the food system.

In some cases, policy actions are taken to deliberately affect resource use in the food system (farmland zoning, for example). Other policy actions affect the resource/food system relationship inadvertently (e.g. actions such as depreciation allowances for irrigation equipment). Both will be considered here.

Farmland Quantity — Concern with the amount and location of the land available for food production is on the policy agenda for nearly every state in the U.S. Some states have had farmland protection policies for over 40 years; townships, counties and other local units have also taken action. Federal steps are more recent.

Officials in charge of farmland protection cite varied policy motives. Some declare that overall adequacy of farmland for food production is the essential purpose. Others more candidly admit that the goal of farmland protection policies is to affect the character of rural areas—to keep them attractive, uncluttered by scattered development. Land use policies which retain large blocks of open land and concentrate development encourage less costly development patterns. Markets allocate land among competing uses based on the users' willingness and ability to pay. Yet converting land from agriculture to nonfarm uses is frequently far easier and cheaper than converting it from nonfarm uses back to agriculture. Private transactions for land can have real impacts on persons not involved in such transactions. Governments may act on behalf of these "outsiders." Public actions guide the pattern of the conversion of land from farm to nonfarm use by altering incentives or choices for market bidders to keep the most productive lands in farming and to direct development elsewhere.

At the national level the "adequacy" aspect of farmland protection is a key policy motive. The idea that any state can really affect national or world food adequacy denies the role of interstate commerce, trade, and even the concept of comparative advantage. But perhaps national policymakers should be worried about the possibility that we will simply pave over our most pro-

ductive land, an acre at a time, and thereby create a future food shortage. There is little evidence yet of any worldwide food scarcity and land markets would likely anticipate such a shortage anyway. But alert and sensitive policy may avoid needless farmland conversion which is expensive to reverse.

Land Quality — Water or wind may rob the soil of its inherent productivity through processes of erosion. Particles of soil may be displaced, thus changing the structure, fertility, permeability, organic content, and other features of the land which is left for production. Of course the soil eroded away goes someplace—perhaps it will simply increase the productivity of a neighbor's farm. More often, sediment causes problems by clogging rivers, streams, or harbors.

Policy issues concern the degree to which government will seek to influence a farmer's land use in its efforts to reduce soil loss. The landowner would seem to have an incentive to protect his/her land for the income or capital value it generates. It seems "society" has decided that for various reasons farmers conserve too little. Perhaps the farmer doesn't recognize erosion because he/she can offset its impact with fertilizers or new varieties of plants. Perhaps inflation or land location mask the impacts of erosion on land value. Perhaps the farmer knows that erosion is taking place but sees no particular economic reason to do anything about it.

Soil conservation policies have been enacted to generate *more* conservation than farmers are willing to buy on their own. The overriding issue seems to be *if* soil conservation is a valid public activity, who should pay for it—farmer—consumer—taxpayer—all of the above?

Water Issues — Water can be a land substitute. It can increase the output on some land and bring more land into production. Both quantity and quality of water are important to performance of the future food system. Without it, plant growth is impossible; with it, the desert blooms; with too much of it, life and commerce are destroyed. Water policy is centrally concerned with distributing water in time and space to serve human needs.

The availability of water for food production or any other part of the food system depends on the various rules and regulations that allocate water among competitors. The 13 westernmost states rule on a "first come first served" approach for both ground and surface water, with rights that may be bought and sold. Eastern water users rely on a common law "reasonable use" approach for ground water and a surface water rights scheme that gives priority to owners of land adjacent to water. Neither system is adequate. The western case provides no incentive to conserve water and gives enormous advantage to those who get there first, regardless of what they intend to do with the water. The eastern approach sets the stage for legal conflict—a benefit primarily to attorneys. There would seem to be a

prevailing public interest in a more deliberate scheme based on some notion of result or return to water as an input.

Cheap water and particularly cheap energy have had a major impact on *where* food is grown. The Ogallala Aquifer caused a major shift in bean production for example, from the corn belt to the drier western states of Nebraska, western Kansas, and the Texas Panhandle region. Some states have virtually no nonirrigated farmland. Whether that is a permanent shift depends on whether water will continue to be available at prices well below any market value.

Unlike most other water users, farmers *consume*, or at least significantly displace, the water they use. Water used by irrigators is not available for others, at least not until it is processed through a plant or animal and re-enters the hydrologic cycle. When irrigation withdrawals begin to noticeably affect opportunities for other users, there will be questions about "reasonable use" in eastern states and demands for more rational allocation in western states. Uncertainty about future water supply will affect farmers' investment behavior. Groundwater depletion has already created problems in some areas.

One of the consequences of erosion is that productive soil is relocated. That can be a problem for the soil loser but an opportunity for those who locate on *rich fertile flood plains* near major rivers. Flood plans also afford attractive building sites for homes, businesses, or factories, including food processing plants and other businesses related to the food industry. The problem, of course, is that flood plains are susceptible to additional flooding. Vast public projects have been undertaken to reduce future flooding, thereby protecting the farmer or other resident who decides to locate there. In the process of protecting downstream farmers, the Corps of Engineers or Department of Agriculture (depending on size of the river and watershed) may create considerable inconvenience for upstream farmers who find their land inundated by a reservoir. The question is whose rights and opportunities should be protected and at whose expense. The human cost of floods is important, and the food system is very much involved.

Farmers spend their own money developing or diverting a water supply, but the *government invests in water supply* as well. In 1980, farmers invested \$36 billion in irrigation, with the federal government adding another \$12 billion. Most of the federal investment is for opening up new lands for farming. Thus many successful farmers in the dry areas of the U.S. owe their very economic existence to public investment. In fact, many farmers irrigate primarily for the capital gains which occur as poor land is made productive. In times of declining federal revenues and the overproduction of many commodities, is this a wise use of public funds? The farmers involved surely think so. In addition to outright expenditures, publicly subsidized credit and

certain depreciation provisions in tax codes have assisted private investment in irrigation.

Great Lakes and open sea shipping remain important means for moving grain and other produce to domestic and foreign markets. With rising fuel prices, water transport may become even more important. Rights to shipping on the open sea and the availability of adequate port facilities at both ends of the move will be crucial aspects of food system performance in the future. The federal government has traditionally maintained the locks and canals that facilitate grain shipment on the Great Lakes. Recent national policy proposals call for increased user charges which could affect where food is produced and how it is shipped. We all depend on the water transport system, yet the matter of who should pay for it and in what proportion is a thorny policy issue.

Each of these issues (and there are others) implies policy choices that will affect the nature and performance of the future food system. To the extent that water in food means less water for something else, disputes will occur over limited supplies. Withdrawals from streams may limit flows for fish or wildlife habitat. Draining swamps, thus relocating water for the convenience of food producers, upsets duck hunters and others who care about wetlands. Cottage owners on a small lake get upset when nearby irrigation lowers the shoreline by a foot or two. When polluted water is produced as the *result* of food system action, legal or political pressure may be brought to bear on the perpetrator. Any action taken to secure water use rights for nonfarmers can affect food system performance.

Energy — Except for direct solar energy as the key to photosynthesis, the energy used in agriculture is primarily fossil fuel. Oil and gasoline fuel the machines that have extended the return to human labor in producing, processing, transporting, packaging, and storing food. Farming and the food system account for 22 percent of total marketed energy used in the U.S. Many farmers are forced out of irrigated production not by water depletion, but by rising energy costs.

Food production in the U.S. is highly specialized. That means heavy reliance on trucks, trains, or ships to get the food to people. Many commodities require energy-expensive refrigeration enroute. One estimate, for example, is that nearly 1 billion gallons of fossil fuel are needed to move the California broccoli crop to consumers around the country. Thus the spatial arrangement of production and consumption depends partly on relatively inexpensive fossil energy in a form that can be readily used.

The chemical pesticides and fertilizers so crucial to modern production technology are energy-expensive. Nitrogen fertilizers require natural gas to convert nitrogen to the usable ammonia form. Similarly, producing potash fertilizers requires considerable energy.

Sudden unexpected disruption of an energy supply

can be particularly devastating to an industry dealing with perishable commodities. Undried grain will quickly spoil or deteriorate. Refrigeration or controlled atmosphere storage systems require dependable sources of energy. During the energy supply interruptions in 1974 and 1978, proposed emergency allocation schemes struck fear into the hearts of farmers, processors, shippers, and the consumers who depended on them.

The usual response to a rise in the relative price of a certain product is to seek substitutes for it or ways to improve efficiency of its use. Such is the case with fossil fuel energy and the food system. Improved irrigation efficiency can provide sufficient water at a lower energy cost. Many farmers use more water than they need. Pumping less water or distributing water through gravity rather than through sprinkler systems can reduce energy costs of irrigation. Perhaps government has a role in helping farmers and others to find these energy saving alternatives and to understand the economic consequences of any changes related to them. An industry or sector so vulnerable to the availability of energy *has* to make adjustments.

Parts of the food system may be particularly amenable to the substituting renewable energy for traditional liquid fuels. Food production is a fairly compact localized activity that may lend itself to on-farm energy production. Farm residues and manures provide the basis for alternative energy sources. Shifting to renewable sources, particularly biomass, will affect farm practices. The farmer may look to greater on-farm processing to make these alternative energy sources worthwhile.

Large farms use less energy per acre than small farms. Thus energy price may influence both the size of farm and the mix of farm enterprises. Since fertilizer entails the largest single component of farm energy use, farmers have an additional incentive to shift to crops requiring less fertilizer or to organic sources of nutrients. Vegetable production is intermediate in energy intensity, between low energy crops like food grains and high energy crops like tobacco and cotton. Nearly half the energy used in food marketing is consumed by refrigeration.

Air — As a production input air has certain “common property” aspects—it is available to anyone who can capture and use it. Unfortunately, too many users return air to other users with a mix of gases that is quite different from that associated with clean “normal” air. Air pollution can affect food production and consumption, as well as the location of farms, food processing plants, and other parts of the food system.

Through the process known as “acid rain,” airborne nitrates and sulfates combine with moisture to significantly alter the chemistry of water, sometimes to the extent that such water is unacceptable for irrigation. Waste gases from the combustion processes of an industrial economy are the primary ingredients of acid rain. While data are scarce, acid rain may have directly affect

growing plants. It can affect the productivity of poorly buffered soils as well.

Airborne toxics may accumulate in plants, thus entering the human food chain. High ozone concentration in the atmosphere has been linked experimentally to reduced outputs of corn, soybeans, and other crops. Scientists have linked the build-up of carbon dioxide in the atmosphere to a possible “greenhouse effect” that would clearly alter many aspects of human life, including food content and the locations where food would be raised. Carbon dioxide traps heat near the surface of the land.

Air quality can be improved, or at least maintained, through various rules or institutions that govern the behavior of the air users. Power generation is the major culprit in acid rain; internal combustion engines are major sources of CO₂ and CO. Food system industries, particularly those which process and transport food, are clearly a part of the problem. The changes required to reduce pollution can increase the production cost of a particular commodity. Policy issues involve linking the reduction of pollution to some evidence of a positive net impact on the consuming public. There is a time dimension, too. Future consumers have a stake in how well and how cheaply we influence the quality of the air available as a resource input for the food system.

Policy Alternatives

Various options are available to alter patterns of resource use in response to these problems. These options correspond to the various authorities of government. Choosing among them determines who will pay for changes in resource use and who can influence performance of the food system.

Planning is the basic authority to systematically consider alternative futures. Planning itself is not action—it does not directly alter access to resources. But it does affect policy by providing information on the social price of the options available, including the option of “no action.” Planning helps establish the logic behind any rule change that may alter resource use. Farmland protection policy at the national level has been limited to mandated planning. That is, the rules have been changed to *require* consideration of the effects on farmland when any federal project is undertaken. *Who* does the planning can influence resource use, since the actions undertaken will reflect the preferences of those involved.

Governments also affect resource use through **taxation**. A change in resource use may result from deliberate tax policy or as an unintended by-product of efforts to raise revenue. For example, governments have sometimes used their tax authority to deliberately alter the incentives facing land users, in order to encourage a pattern of land use more consistent with certain social objectives. Some states require that farmland be taxed on current use rather than on market value as is done

with other land. The purpose behind such requirements is to reduce that part of the cost of farming and thus to encourage continued farming on that land. Other states tamper with the state income tax by providing certain credits for farmland users. The policy relevance is obvious. If one reduces the property tax burden for farmers in a particular area, other local property owners must pick up the added burden. If the income tax is altered, on the other hand, all income earners of the state may be affected while burden on any one will be small. In either case, the costs of encouraging farmland protection are likely to be hidden and the actual performance of those tax adjustments is hidden as well.

An administrative pricing system for water for production or transport would alter the incentives for water use. If the price were high enough, it would affect the location of various parts of the food system.

Tax incentives may be applied to encourage farmers to adopt soil conservation practices. One proposal would reward conserving farmers by providing an outright bonus payment for reducing erosion. The counterpart option would tax sediment lost from a field. In either case, the farmer's right to permit erosion would be influenced. A major difference in this case is the allocation of the burden for increasing the level of soil conservation.

Governments may **regulate** private actions on behalf of the health, safety, and general welfare of all. Local governments use land use zoning to limit the conversion of farmland to nonfarm use. The idea is that any resulting constraint on the landowner is more than offset by the benefits to others in the community. Zoning simply specifies the land uses available to landowners consistent with some predefined pattern of land use identified in the planning process. Air and water quality standards limit alternatives for the resource user. Regulations require enforcement, often a hidden cost in comparing policy options.

In order to accomplish changes in resource use, governments may **acquire selected rights** from individuals. In this case, taxpayers pay for any adjustments in opportunity for individual resource users. Policy change is accomplished by direct transfer of the rights necessary to realize a given social objective. Several local governments have allocated public tax dollars to programs to acquire development rights on private farmland. Once such a right is purchased, the farmer cannot sell his land for development—thus the retention of that farmland in undeveloped use is secured. The cost is spread among taxpayers in proportion to their tax liabilities.

Resources as Food System Outputs

While natural resources contribute various inputs to the food system, the food system itself may *produce* resources or have effects on them. Some of these resource products are intentional, some are not. Policies to reduce certain food system outputs (such as eutrophication in lakes) can subsequently affect that food system.

Output Issues

The policies on the output side are complex and closely interrelated. Actions taken to “solve” one problem may create a dozen others. The most important output issues are the following:

Agricultural Nonpoint Pollution — Soil Erosion may simply mean that soil is dislodged from one field to another. But some sediment gets to nearby streams or lakes, carrying with it various nutrients or chemicals that cause problems for other water users. In response to such damage, the public has demanded institutional change to discourage land users from permitting this soil runoff to occur. The 1977 Rural Clean Water Act gives particular attention to nonpoint pollution from agriculture. Proposed rule changes range from educating farmers to help them understand the off-site effects of erosion to the outright prohibition of farming practices that permit unacceptable levels of runoff. The full range of policy options discussed above may be used to deal with these resource-related outputs of farm production. The most familiar institutional approach is federal, state, or local sharing of the cost of installing on-farm soil conservation practices. The prevailing policy issue in choosing among these options, of course, is *who* will pay to reduce this particular resource output of the food system.

Farmland as a Waste Processor — Soil has an enormous natural cleansing capacity that has been marshalled by communities and industries all over the U.S. Wastewater and sludge from municipal treatment plants provide sources of moisture, nutrients, or organic matter that farmers may value. Thus application of that waste to farmland benefits all concerned. Some waste water or sludge is too loaded with toxics or other hazardous substances to be acceptable. State health departments have been very cautious about permitting applications of human or industrial waste on land that is used to produce food for direct human consumption. But within limits and within the practical constraints of timing and volume, farmland can be a natural and productive waste treatment system. This is an important resource service of the food system that may be used more extensively in the future.

Wetland Protection — Wetlands or swamps, as they used to be called, may be a resource problem to the farmer but they are highly valued by many environmental groups. In order to protect the qualities and services that natural wetlands provide, recent policies have discouraged, or even prohibited, farmers or others from draining them. Wetland protection rules affect a farmer's opportunities. The decision to withhold SCS technical assistance from a farmer whose actions would drain wetlands, for example, may impinge on his or her production choices. Wetland preservation policies have

been passed in several states. Some of these specifically exclude farmers but others require them to comply with the established regulations. The policy problem is to determine under what circumstances these costs of preservation are "too high" and when we have preserved enough wetlands to meet the demands for services which they provide.

Noise and Nuisance — Agricultural production is frequently a very noisy and smelly business. That fact is tolerated by some people but not by others. People who moved into the country for the scenery and the fresh air may raise reasonable objections to common farm practices. Various nuisance ordinances and antifarm regulations have been passed in communities across the country. People have sought relief from what they deemed to be unacceptable interference with their enjoyment of the combination of natural resources and spatial isolation known as "the rural life style." The policy issue is obvious. In order to remain competitive and economically viable, agricultural producers need certain kinds of freedom related to normal practices. At the same time, nonfarm residents have a right to be protected from unreasonable interference with their living situations. Some have argued that because the farmers were there first, their rights should prevail. Generally the courts have not agreed. In many states the result has been the consideration or passage of so called "right to farm" laws. These laws simply establish the fact that farmers have certain needs which must be protected and declare that normal farm practices are never to be considered a "nuisance." The legality of such laws is yet to be fully tested. Thus we may consider certain noise levels and odors as resource by-products of the food system which impose costs on others. The laws enacted to reduce those costs affect the opportunities and character of the food system as well as the location of its components.

Biomass Energy — Animal and plant organic matter produced as part of agricultural output can be an important source of biomass for energy production. Farmers have been among the first to use plants and other organic matter as energy for their own needs. Serious attention is being given to the intensive production of energy crops. The most common technology involves converting organic matter to alcohol for use in liquid fuels. An alternative involves producing methane from organic decomposition to be used as a gas for drying or other purposes. Energy policymakers now seek alternatives to traditional liquid fuels, and the land available for producing food will be increasingly attractive for producing energy. The issue of "food or fuel," with all its related questions of feeding the starving populations of the world versus providing adequate energy for the energy intensive lifestyle in the U.S., will become increasingly important. The economic attrac-

tiveness of these alternative energy supplies is partly a function of international policy. Incentives to *increase* alcohol production can affect our food production system.

Summary

To return to an earlier assertion, there are virtually *no* actions in the food system that are unconnected to natural resources. The only policy questions concern which of the links between the two are most crucial and how these links may influence the design of food system policies. The food system is not a set of discrete functions that may be treated separately. Actions to affect one set of options for one category of food system factors will alter incentives and choices throughout the system. Policy research must *focus* on these links—to help clarify, for example, how actions taken to reduce nonpoint pollution affect the location of production—or how efforts to preserve farmland may affect the evolution of new production technologies.

Even *within* the resource/food system set of concerns, complex interactions occur. For example:

—**Conservation tillage** is touted as a resource policy option that benefits everyone. It reduces both erosion and short run production costs for farmers. However the National Audubon Society is not convinced of the universal goodness of reduced tillage. Such tillage requires the application of large quantities of pesticides which may incidentally destroy birds and other valuable animals and plants. But reduced tillage means that the land holds moisture better, reducing irrigation needs and all the problems associated with irrigation.

—**Water** increases soil productivity, but it involves runoff that can damage downstream water uses. Soil nutrients dissolve in water, requiring the addition of energy-expensive artificial fertilizers. Since irrigation is energy-expensive, rising energy costs can encourage water conservation and all that goes with it.

—**Air Pollution laws** require pushing the pollutants higher into the atmosphere, thus extending their impact over a broader area while improving air quality close to the polluter. Controls on particulate matter in waste gases may actually reduce the buffering of nitrates and sulfate, thus increasing the acid rain problem.

While the complexities of food system/resource links are awesome, we need not be paralyzed by indecision. Government bodies must take actions to deal with the specific results of food system performance which are seen as "problems" by a significant segment of society. But they must take such actions cautiously. Sound policy depends on an accurate understanding of the rippling effects beyond the targets of each particular policy. Subsequent papers in this farm and food system in transition series will further identify those effects.

Agriculture Policy:

A Citizen's Guide to the American Food and Fiber System

Soil Conservation Policy for the Future

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SOIL CONSERVATION has not always been a matter of U.S. national policy. Prior to the 1930's, the federal government had made a few efforts to inform farmers of the problems associated with soil erosion, for example, through an 1894 United States Department of Agriculture (USDA) bulletin, *Wasted Soils: How to Prevent and Reclaim Them*. Ultimately, however, it took a combination of events to add soil conservation to the national policy agenda. These events were the Great Depression, the severe droughts of the early 1930's, and the presence of a unique spokesman for the soil conservation cause, Hugh Hammond Bennett.

Bennett became convinced of the dangers of soil erosion as early as 1903 when he was mapping soil types for the USDA's Bureau of Chemistry and Soils. While mapping, he came across numerous examples of soil erosion throughout the country. His experience motivated him to lecture extensively about soil erosion problems in order to convince farmers and legislators of the dangers of erosion. Bennett's effort eventually resulted in federal funding for soil erosion research. Stronger legislation soon followed as a result of the Great Depression and the 1930's droughts.

The Great Depression put nearly one-quarter of the labor force out of work at a time when there were no public welfare programs, unemployment insurance policies, or food stamps. The Depression also meant that farmers, faced with high debts and low prices, could not afford to practice soil conservation. In 1933, President Franklin D. Roosevelt requested Congress to authorize \$5 million for soil conservation projects, both to combat erosion and to increase employment. Congress did so, under authority of the National Recovery Act of June 16, 1933 (P.L. 73-67).

Then, in 1934, severe droughts hit. Dust storms carried soil from the plowed fields of the Great Plains all the way to the Atlantic Ocean. Although likely an apocryphal claim, it is said that one of these storms rained dust on Washington, D.C., in April 1935, as Congress was considering H.R. 7054, the Soil Conservation Act. The act, which later passed, declared the policy of the U.S. was: "... to provide permanently for the control and prevention of soil erosion . . ." The

act also established the Soil Conservation Service (SCS) as a permanent agency within the USDA.

The Soil Conservation Act was followed by passage of the Soil Conservation and Domestic Allotment Act of 1936, which provided government payments for farmers who adopted soil conservation practices, primarily to reduce acreages of "soil-depleting" crops. Then in 1937, the Standard State and Soil Conservation District Model Law was formulated with hopes that it would be adopted (in some form) by each state. The model law outlined a process by which local soil conservation districts could be voluntarily established within a state and used to promote soil conservation practices. By 1947, all states had passed soil conservation district enabling laws. Today there are 2,950 soil conservation districts which collectively cover approximately 2.2 billion acres (Dallavalle and Mayer, 1980).

Although various programs were added to those of the 1930's over the next three decades, soil erosion itself aroused little public interest. To most Americans, it seemed that action had been taken to deal effectively with the problem. With the events of the 1970's all this changed.

The 1970's

The 1970's saw the first major interruption of several decades of U.S. agricultural surpluses. Before 1973, U.S. agriculture had excess resources, both in land and in the number of farmers. These resources, coupled with government programs that supported some farm prices above market levels, resulted in substantial annual surpluses of agricultural commodities. In the face of overflowing silos, soil conservation was perceived as an issue of little urgency.

But grain exports increased dramatically in 1973 when the Soviet Union began buying large quantities of foreign grain. Grain exports in 1973 were nearly double those of 1972. The 1974 prices of wheat, soybeans, and corn rose above 1970 prices 208 percent, 133 percent, and 128 percent respectively. The increase in harvested cropland was spectacular and predictable: from 1973 to 1974 there was a net increase of 24 million harvested acres.

The material in this paper is drawn extensively from Soil Erosion: Crisis in America's Croplands, Sandra Batie, 1983.

David L. Chicoine, University of Illinois at Urbana-Champaign, and R. Mack Gray, Soil Conservation Service-USDA, contributed reviews of the paper. This is one of a larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

With agricultural exports considered essential to improving the nation's balance of payments, farmers of the 1970's were encouraged by Secretary of Agriculture Earl Butz to plant "fence row to fence row." And they did. Harvested lands were used more intensively. Pastures were plowed and planted. Marginal agricultural lands were cultivated, often for the first time. From 1967 to 1977, over 2 million acres of newly cultivated cropland came from lands with poor soil.

As farmers plowed under more land to take advantage of rising prices, old conservation practices were lost. Narrow terraces, suitable for the smaller and lighter farm machinery of the 1960's, were plowed out and the contouring of fields was abandoned because of incompatibility with the machinery of the 1970's.

In response to the increased export demands, harvested cropland reached 391 million acres by 1981, up substantially from less than 335 million acres in 1972. Partly as a result of these trends, the quality and quantity of America's croplands became a national concern.

The environmental movement that gained visibility in the 1970's also drew attention to soil erosion. When water quality became a major concern of environmentalists, it was only a matter of time before the demands for cleaner water focused on one of the chief pollutants—soil eroded from agricultural lands. The environmental concerns introduced a new set of soil erosion critics, who questioned the objectives and practices of USDA agencies and soil conservation districts (Unger, 1979).

The Accountability Crunch

In the late 1970's, serious criticisms of the nation's soil conservation programs began to emerge. After being in operation for almost 50 years, public programs addressing soil erosion were accused of being ineffective and expensive. Some critics even charged that soil erosion was worse than it had been before the programs were initiated (Barlow, 1979).

In 1977, the comptroller general of the U.S. prepared a General Accounting Office (GAO) report for the Congress entitled *To Protect Tomorrow's Food Supply Soil Conservation Needs Priority Attention*. The GAO visited 283 farms throughout the nation and found that 84 percent of these farms were suffering annual soil losses above the levels regarded as allowable for sustained productivity (U.S. Comptroller General, 1977).

After 50 years of use, why were the public programs found so ineffective? The reasons are complex but informative. One reason is that conservation, like house-keeping or yardwork, is a continuing process. To be effective, some conservation practices must be maintained on a continuing basis. Thus as the number and location of cropland acres changed over the decades, and as crop technology changed, new conservation efforts were needed despite large conservation expenditures made in the past.

A second reason is that past soil conservation programs were not targeted to fund the most assistance where conservation practices would be the most effective.

This resulted, in part, from the 1930's philosophy of supporting farm income via soil conservation programs but it probably continued as a result of the pressures under which the SCS and the ASCS operate. Both agencies need the popular support of farmers and thus have considerable incentive to spread program benefits widely. Thus the eligibility criteria of the programs were not related to erosion rates. Even if program managers had attempted to focus assistance on farms with the greatest erosion problems, the lack of data on the nature and extent of soil erosion would have limited their ability to do so.

Factors Influencing the Adoption of Conservation Practices

But why do farmers not implement soil conservation independently of government programs? A major reason is that many conservation practices do not pay for themselves. However, this is not because the practices are ineffective. Farmers can choose among many soil conservation techniques such as changing the characteristics of a field's topography with terraces, planting only the least erosive lands, rotating crops, strip cropping,* planting on the contour, retaining crop residues on the field surface after harvesting, constructing waterways, or using conservation tillage methods such as no till.** Alone or in combination these techniques can reduce erosion rates 60 to 95 percent.

Many of these techniques are not profitable, however, and a business-minded farmer who must remain competitive to remain in farming is simply not interested in such practices if they do not pay. Even a farmer with a strong land ethic and a desire to practice soil conservation may find it financially impossible to do so. There are other reasons why farmers do not adopt soil conservation practices. Some barriers are raised by the investment incentives in rising land prices, land tenure arrangements, and tax policies. Some simply stem from a farmer's preferences and beliefs.

Costs of Conservation Practices

Practicing conservation involves changes, all of which have costs. No till cropping, for example, may require the purchase of new equipment and will probably require more agricultural chemicals than other kinds of cropping. Elimination of fall plowing means that a farmer must spend more time preparing for planting in the spring when time is very valuable. Adding forage crops as part of a conservation plan usually means adding livestock. Doing so requires fences, specialized equipment, and local markets for feed, antibiotics, veterinary care, and other inputs.

*Strip cropping involves growing crops in a systematic arrangement of strips or bands that serve to catch field erosion.

**No till eliminates almost all tillage. There is no seedbed preparation before planting. Usually residue cover is retained and cut through only to plant the seeds. Chemicals, rather than conventional plowing, are used to control the weeds.

Also, farmers buy and own farms—not fields. If part of a farm includes inferior, more erodible soil classes which are surrounded by better soils, the farmer may find it uneconomical, as well as inconvenient, to treat the more erosive lands differently. If the farm is being used to grow corn and soybeans, for example, the farmer will not normally find it practical to deal with an “island” of erosive soil by fencing it and using it for livestock, or by sowing different crops on it or letting it lie idle. Ownership boundary lines can also interfere with contouring or terracing.

For the business-minded farmer, a decision to maintain, improve, or deplete soil is an investment decision. For some tracts of land, conservation may be economical for the farmer when the land is first cultivated. This might be true on land that is fairly flat, where the topsoil is shallow but highly productive and the subsoil is of substantially poorer quality. In this situation, the loss of an inch of topsoil could reduce yields dramatically; erosion could be reduced inexpensively if, for example, contour plowing or residue retention were used.

On other tracts of land, where conservation requires major land-moving technologies to form terraces, and where straight-row, highly erosive cropping patterns can bring a high dollar return, private economics may dictate mining the soil. This is particularly true where the original topsoil is very deep. Also, when erosion problems are mainly off-farm, such as reduced nearby water quality, farmers have little incentive to conserve.

Other financial factors also influence the farmer's decision about whether to conserve soil. For example, the lower the price of soil substitutes such as fertilizers, the less likely the farmer is to conserve. Also, the lower a farmer's current net income, the less likely he or she is to conserve, since substituting future income for present income is financially impossible.

While the majority of conclusions from research studies state that most soil conservation practices are not economical investments for farmers, there are exceptions. Such exceptions appear to be conservation tillage, contour plowing, and leaving residue on the field after harvest. In some areas of the nation, these practices are effective in reducing erosion and may even increase profits.

Personal Preferences

Reasons other than the possible high costs involved often influence decisions about conservation. Many farmers just do not perceive the same need for soil erosion control as do soil conservation specialists. Several researchers have found that failure to see the need for erosion control practices was a significant factor in explaining the failure to adopt them. In one survey in Nebraska, “the SCS classified 82 percent of the farms as having a major soil erosion problem while only 2 percent of the operators and none of the landlords classified their farms similarly. Moreover, 54 percent of the operators and 55 percent of the landlords indicated either no or few erosion problems; yet SCS

classified only 4 percent as having no problem” (Hoover and Wiitala, 1980).

The authors of the study suggest that the different perceptions come partially from different perspectives. “SCS classifies soil erosion problems in terms of the amount of soil movement. Operators are more likely to classify problems in terms of the difficulties caused by soil erosion, the visibility of soil movement and the short-run effect of erosion on the economic, physical and operational aspects of farming” (Hoover and Wiitala, 1980). In general, a greater proportion of the younger operators agreed with SCS advice than did older operators.

Other factors also inhibit conservation practices. Some farmers want clean fields and straight rows no matter what advice they are given. Others have little confidence in the effectiveness of the soil conservation practices being recommended and therefore do not adopt them. Still others dislike government involvement and requirements. Also farmers have differing backgrounds, educations, experiences, managerial skills, planning horizons, and attitudes toward risk taking. All of these factors substantially influence a farmer's willingness to adopt soil conservation practices (Nowak and Korshing, 1981).

Land As An Investment

Decisions about soil conservation are complicated by the multiple reasons that exist for owning farmland. Production of food and fiber is only one. Investment is another. Investment in cropland has been an excellent inflation hedge. One study found that over half of the benefit from owning farmland in the years from 1920 to 1978 resulted not from what the land produced but rather from what it contributed to increases in the owner's net worth (Castle and Hoch, 1982). But the result of using land as an inflation hedge is often increased soil erosion.

Since the mid-1970's we have had a tremendous increase in the price of land and the cost of farm equipment. So we now have farmers who look upon farming as a real estate game. They buy the land and farm the hell out of it to meet their heavy payments, not worrying about preserving it because they believe it will keep going up in price . . . It's like buying a rundown building in New York City and letting it deteriorate still further, knowing you'll still have the capital value in the end (Crittenden, 1980, quoting Earl Heady).

Tenure Arrangements

Insecure property rights also work against soil conservation efforts. If a farmer cannot capture the future gains that arise from conservation decisions, he or she will have no incentive to conserve. Thus if a farmer expects either to sell the farm shortly or to have the lease cancelled, that farmer has little reason to begin conserving. Leasing arrangements also may lessen conservation incentives. Former Secretary of Agriculture Bob Berglund claimed that, “Our biggest problem is per-

suading absentee landlords to plow some of their earnings back into the soil” (Crittenden, 1980).

Tax Policies

Tax policies can also encourage soil-depleting practices, even though such impacts are often unintended. Major influences leading to soil depletion are the tax advantages that encourage farmland speculation: deductibility of interest on borrowed funds as a business expense, investment tax credit, several methods of computing accelerated depreciation, and the treatment of any capital gains.

The existence of a preferential capital gains tax in this market draws capital into real estate, not by the promise of higher earnings but by the promise of greater value retention. This distorts investment patterns, displaces operators whose focus must be on income flow rather than on net worth, and encourages patterns of land use that will minimize supervisory cost while waiting for land value to rise (Raup, 1980).

Soil Erosion and the Future

The social significance of farmers’ failure to conserve soil depends on the impact of soil erosion on both environmental quality and future harvests. It is extremely difficult to quantify the effect of soil erosion on air and water quality, but there is a relationship. Runoff from farmland carries sediment, pesticides, and nutrients, all of which are considered pollutants when found in excess. Sediment can reduce the lifetime of lakes and increase dredging costs. Excessive nutrients can lead to eutrophication of water bodies; excessive pesticides can be harmful to fish and wildlife. Air quality can similarly be diminished by excessive amounts of dust. Still, a reliable measure of these damages is not available.

There is more research with respect to the effect of soil erosion on future productivity. Such studies have shown that on many soils a relationship exists between soil erosion and reduced yields. The ultimate effect of erosion on yields differ by soil type, by crop, and by management practices. In some soils, farmers can improve their yields and compensate for the effects of erosion with the increased use of fertilizers, improved plant varieties, or various farming techniques.* “Historically, the positive effects of [these] technological change[s] on productivity have outweighed the negative effects of erosion” (Crosson, 1982).

Some agricultural researchers fear that the rate of such production increases will slow in the near future. For one thing, inexpensive energy and plentiful water seem to be things of the past, and new avenues of inexpensive growth are not readily apparent. For another, it appears that the growth of agricultural productivity has already slowed. The average rate of change in total pro-

ductivity declined from 2.2 percent annually during the 1950-65 period to 1.8 percent annually during 1965-79.

Some experts fear that cropland productivity growth will remain slow because of insufficient funding for research. They cite the large contribution that investment in research and education has made to U.S. agricultural productivity growth in the past, and they are disturbed about the lack of growth in government funding. If these researchers are right, greater demand for food and feed grains may be met only by greater use of inputs, including land.

Unless new technologies that can once again boost yields per acre are developed, technologically induced changes can no longer be counted on to substitute completely for the natural productivity of the land. The effects of soil erosion on yields will then become more evident in those areas with little topsoil remaining. The actual significance of any reductions in yields will depend on future demands for U.S. agricultural products.

There are, however, experts who are optimistic about developing new technologies for the enhancement of agricultural productivity, including those no longer dependent on inexpensive water, energy, or land. Many of these anticipated breakthroughs will come, they envision, from the biological sciences and plant and animal genetic research. If their predictions are accurate, present erosion rates will result in a far lower future productivity “price to pay” than if the more pessimistic visions of the future prove true.

The Shape of Conservation Policy

Much uncertainty remains about the importance of soil erosion to future food and fiber production, but it is precisely this uncertainty that makes the case for public concern and public action: “In the absence of good information we should be cautious with our limited soil resources” (Libby, 1982). The policy dilemma is both to protect air and water quality and to preserve the option to use more soil in the future, while at the same time not to be overly conservative. Soil conservation is not costless any more than is soil erosion, and to spend too much on erosion control or to spend dollars inefficiently is to deprive society of other valued goods such as schools, roads, or aid to the destitute.

The uncertainties surrounding soil conservation choices make the policy choice more one of providing insurance against the worst case possible than of selecting an “optimal” policy. Deciding how much of a premium to pay for this insurance or how to use that premium in a most cost-effective manner is not easy. Nevertheless, the worst case future that might result from inaction is sobering and that suggests that there is wisdom in making some sacrifices today to insure against such a future becoming a reality.

There is a substantial data base with which to analyze the effectiveness of past soil conservation programs. This data base is augmented by research findings generated or compiled as a result of soil conservation’s new visibility on the public agenda. Although there are

*If erosion has reduced the water-holding capacity of the soil, the rooting depth, or the water infiltration rate, however, the addition of fertilizers may not offset the yield-reducing effects of erosion (Shrader and Langdale, 1979).

numerous policy and technical questions yet to be answered, what has been learned to date can serve as a catalyst for genuinely improving soil conservation programs.

In the light of these data, some strategies seem to have considerable potential for reducing erosion problems in a cost-effective manner. They include targeting of conservation efforts; removing the most erosive lands from crop production; encouraging or requiring farmers to adopt low-cost conservation practices, such as reduced tillage, residue retention, and contour plowing; and employing some cross-compliance strategies. Other insurance investments include funding research designed to reduce the difficulties of adopting conservation practices (for example, improved weed control with conservation tillage) and to reduce the need for land as well through improving yields per acre. Many of these strategies have the advantage of preventing erosion before it begins rather than restoring damages caused by erosion after the fact.

Targeting

Targeting is the selection of certain regions and of areas within such regions to receive most of the publicly funded conservation investments. Since most sheet and rill erosion occurs on only a small proportion of the nation's total cropland acreage, targeting can be a reasonably cost-effective way to reduce erosion. Almost 70 percent of the nation's erosion exceeding 5 tons per acre per year occurs on less than 8.6 percent of the nation's total acreage (Ogg and Miller, 1981).

Despite this concentration of erosion problems, past cost-sharing programs have dispersed assistance widely. Less than 19 percent of the soil conservation practices installed so far have been placed on the most erosive lands. Over half of the cost-shared practices have been placed on lands with erosion rates of less than 5 tons per acre per year (USDA, 1981). Policies could be made more cost-effective if this pattern were changed and if public programs were directed at farmers whose lands account for the lion's share of erosion problems.

Targeting dollars to areas of greater erosion potential, however, should not mean that *every* highly eroding area is protected or reclaimed. Some areas are so severely eroded that thousands of dollars per acre could be spent with little improvement in the land's productivity. The relative benefits to be gained should be balanced against the costs if truly cost-effective strategies are to be developed.

One problem with targeting is that of establishing criteria for selecting areas. If maintaining soil productivity is the primary objective, then it may make sense to target those areas with fertile but shallow topsoils, regardless of erosion rates. If water quality goals are primary objectives, then targeting might be focused on areas with high erosion rates regardless of topsoil depth.

Another issue to be resolved concerning targeting is that of equitable distribution of public assistance. If

public subsidies in the form of cost-sharing are given to the farmers with the most severe erosion problems, is past "poor" soil stewardship being rewarded and "good" stewardship slighted? It would appear that, unless they are carefully designed, the conservation incentives of such a program could result in poor use of the soil.

Removing the Most Erosive Lands

Removing the worst of the highly erosive lands from soybean or grain production is another possibility.

The evidence strongly suggests that it is not possible to cultivate inherently erosive land and hold erosion to predetermined levels even by using multiple erosion control practices. Yet this land is responsible for the bulk of the erosion problem. Unfortunately, current programs attempt to reduce erosion to 5 tons per acre while land remains in cultivation—an unrealistic objective that is used to justify bureaucratic programs that consume far too many resources for the amount of soil they save (Miller, 1981).

These highly eroding lands are often not very productive. For example, 35 percent of all erosion in western Tennessee is estimated to occur on 15 percent of the cropland which produces only 7 percent of total agricultural production in Tennessee (Parkins, 1979).

Arguing for a removal policy assumes, however, that the benefits to be gained in improving water quality and in using the land for crop alternatives, such as pasture and forest, are considered worth the loss of these lands for crops. Lands can be removed from crop production by outright purchase or purchased easements, long-term rental arrangements, zoning for types of agricultural use, or mandatory regulations. Each of these suggested policies has drawbacks, not the least of which can be high enforcement costs to ensure farmer compliance.

Adopting Low Cost Conservation Practices

While regulation to achieve soil conservation and water quality goals is certainly a viable option—and one which is being used in several places—acceptance of it is not widespread. Although soil conservation and water quality protection are widely held public objectives, so, too, is the protection of private property rights. As in the case of many resource issues, two widely shared objectives are in conflict.

However the regulatory approach has passed at least one constitutional test (in Iowa), and its acceptability would probably improve if farmers were guaranteed financial assistance to cover the costs of complying with a regulated conservation standard. Perhaps, also, regulations could be directed only toward those farmers with the greater erosion rates. Since minimum tillage, residue retention, and contour-plowing practices can be economical investments in many situations, farmers could be required to adopt such low cost techniques with little negative effect on incomes and considerable reduction in soil losses.

Instead of regulation, public cost-sharing of conser-

vation practices might be used to encourage farmers to adopt low cost practices. Cost-sharing arrangements have the distinct advantage of being easily designated for particular areas and for particular conservation practices. Short-term agreements can give a farmer the needed incentive and financing to implement practices. Long-term agreements help to assure some longevity for any adopted practices.

Cross-compliance Strategies

Cross-compliance strategies are incentive programs. The farmer receives extra benefits from other agricultural programs for adopting soil conservation practices or loses benefits for not adopting them. For example, in what has been termed the "green ticket" approach, farmers might receive higher price support payments for their crops if they participated in soil conservation programs. In a "red ticket" approach, farmers who did not participate would lose out on specific federal program benefits.

If cross-compliance is linked to price support or other commodity programs, and if these programs are inactive in times of high food demand, then cross-compliance strategies will not be effective unless long-term benefits are included. For example, farmers might cross-comply to be eligible for *future* program benefits as opposed to *present* ones.

While most discussions of cross-compliance focus on price support and production adjustment programs, numerous other programs could be considered cross-compliance candidates. Loan and credit programs are examples. In order to obtain a loan at a reduced interest rate, a farmer would have to be in compliance with a soil conservation plan or would have to implement those conservation practices which are relatively low cost, such as retention of residue. Other candidates include disaster and crop insurance programs and state use-value assessment programs, in which farmers are taxed on the agricultural value of their land rather than on its market value.

For cross-compliance to reduce soil erosion effectively, participating farmers would need not only to receive positive net benefits, but they would also have to be those farmers whose lands are seriously eroded. Two likely program candidates for cross-compliance are the price support and acreage diversion programs. Participation in these commodity programs is not evenly spread across the nation, however. Thus cross-compliance linked to these programs would have considerably more impact in some states than in others. Texas, for example, has much of its acreage in corn and cotton, both of which have strong commodity programs. On the other hand, West Tennessee, like many other regions in the upper Mississippi Valley, has a substantial amount of land in soybeans for which few commodity programs exist. Hence cross-compliance strategies tied to existing commodity programs will favor Texas over Tennessee and other upper Mississippi Valley states (Clayton and Ogg, 1982).

Research

Other techniques involve increased research. Some research programs will be undertaken by private firms; however, many will need to come from universities. This will require both an infusion of new funds and the assurance of continuity of research funding. Research results that improve the productivity of inputs may reduce the amounts of croplands devoted to growing grains and soybeans. For example, developing higher-yielding plants could reduce the amount of land required to meet a given demand; improving the efficiency of the food-processing-and-marketing sector to reduce loss and spoilage would be equivalent to increasing yields per acre; developing better weed control for minimum tillage would make conservation tillage techniques more profitable. Other needed research efforts include those designed to reduce uncertainty about the impact of soil erosion on productivity and water quality and those which provide information for improving soil conservation policies and encouraging the adoption of soil conservation practices. Examples include analyses of the impacts of implementing the various targeting or cross-compliance proposals.*

Other Techniques

Other possibilities are more controversial. Reducing food and fiber exports to other nations and improving other countries' capacities for food production with appropriate technology transfers and aid programs would remove some of the pressure from American lands. Shifting consumer demand away from grain-fed animals, especially beef, would cut down on acreage used in the more erosive crops of corn and soybeans.

Present Policy Directions

Some of these possible strategies have been encompassed in recent USDA agency planning. In December of 1982, the Secretary of Agriculture presented to Congress a *Program Report and Environmental Impact Statement* in response to the provisions of the Soil and Water Resources Conservation Act of 1977 (USDA, 1982). As part of the final report, the secretary expressed his intent to redirect USDA activities, to target 25 percent of conservation technical and financial assistance, and to consider matching state and local funds by awarding grants to those Soil Conservation Districts experiencing severe erosion problems. The report also details the USDA's intent to request conservation plans from farmers applying for some Farmer's Home Administration loans, to emphasize conservation tillage, to resolve inconsistencies in various agency programs, to increase the use of long-term agreements with farmers, and to set up pilot projects to test new approaches for dealing with soil erosion problems. Thus it appears that the USDA will redirect some of its current programs to

*See W. E. Larson et al. (1981) for a careful discussion of soil conservation research priorities for the nation.

yield more soil retention or improved water quality per conservation dollar spent.

In the near future, though, increased funding for conservation programs is not likely, and some of the changes proposed by the Secretary of Agriculture will encounter considerable opposition both from within and without USDA (Batie, 1983). Furthermore, the recent return to large crop surpluses means that policy-makers will probably not make conservation a high priority. It is difficult to argue for soil conservation to protect future productivity when silos are overflowing with grain. (However, a cogent argument can be made for conservation to improve water quality regardless of surplus crop conditions.) Also, while the current crop reduction programs should reduce erosion as acres are temporarily removed from crop production, these effects will be short-lived when crop prices rise. When this happens, farmers will once again plant their retired acres in crops and increased erosion will result. Yet a prudent policy stance is not to adopt conservation only when it is convenient to do so. An improved soil conservation policy which provides incentives to conserve soil in all crop years (with the possible exception of years of extreme food shortages) is yet to be designed. While the preferred program of the USDA Secretary does have elements that move federal policy in this direction and is an impressive contribution to soil conservation given today's political and financial constraints, a policy that will truly provide cost-effective incentives for long-term conservation is still evolving.

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VI. RESEARCH AND EDUCATION

- **Research and Development for the Future Farm and Food System**
- **The USDA-Land Grant University System in Transition**
- **Genetic Engineering and the Future of the Farm and Food System**

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Research and Development for the Future Farm and Food System

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THE U.S. FARM AND FOOD SYSTEM is highly commercialized and interdependent with other sectors of the economy. Modern agriculture depends heavily on industrial inputs—e.g., machinery, equipment, fuels, chemicals, building materials. Likewise, industries and consumers depend on the primary products which come from agriculture. Interdependency extends beyond the domestic economy as well. We depend on foreign sources for oil, several vital minerals, manufactured goods, and several important foods such as bananas, cocoa, coffee, and pineapples. Likewise, much of the world depends on us for essential food grains, feed grains, oilseeds, industrial machinery, military hardware, and high technology. In today's highly complex, interdependent world economy, consumer well-being depends on the efficient functioning of all its components. Much of the world's food problem stems from inefficient means of preserving food and distributing it, inadequate consumer buying power, or constraints on primary farm production.

This paper examines the role of research and development for the future farm and food system. We first examine the relationships among research and development (R&D), technological advance, and economic growth (productivity advance), then discuss the economic benefits from public research and extension (R&E) and private R&D in the farm and food system as well as the distribution of these benefits (and costs) among different groups of society. Public and private funding for farm and food system R&D is examined and some of the characteristics of the R&D programs of public institutions and private industry are identified. Finally, we identify some of the policy issues and alternatives for future R&D activities.

The Relationship Between R&D and Economic Growth/Productivity

There are two kinds of economic growth: the quantitative growth experienced in most areas of the world—more people, therefore more workers, more equipment, and more output; and qualitative growth—more output per unit land area or per worker, more income per capita. It is this latter kind of growth in productivity which is of prime interest for the future farm and food

system. Almost all of the future increases in agricultural production must come through qualitative growth—from higher yields and increased production per unit area of land.

The advance of knowledge has contributed to both kinds of growth. Improved measures of nutrition, public health, and medical care have cut infant and child mortality, accelerating growth in population. Gains in agricultural productivity and improvements in machinery and transport have provided the basis for the industrial revolution. Most of the historical growth observed in population and output and in output per worker has occurred within the last two centuries. This growth has been intimately connected with the rapid development of science and technology during this period.

New and more efficient technologies for primary farm production and food manufacturing and distribution stem from both fundamental and applied research. Developing and disseminating new knowledge is the responsibility of the public institutions. The knowledge evolving in such institutions is readily available to all potential users. Private businesses utilize both public knowledge and the results from their own research in developing products and processes. This interface of the public and private sectors helps secure an efficient, competitive farm and food system.

Analysts encounter difficulties in measuring the contributions which R&D make to gains in productivity. Three steps are essential in this process. One must first measure R&D, then measure productivity gain, and finally establish the relationship between the two. Efforts at measurement have proceeded at three levels—the single innovation, the level of the firm, and the level of the industry.

Our primary interest is in what R&D has contributed to productivity gains at the industry level over a period of years. We need to know whether the R&D contributions to productivity gains in the farm and food system have proven stable over time, whether we can base generalizations about the future on how R&D has affected productivity gains during a given period of time.

At the industry level, the consequence of R&D most closely related to growth of the national economy is productivity increase. This increase is measured by first

Carleton C. Dennis, University of Maryland, and Vernon W. Ruttan, University of Minnesota, contributed reviews of the paper. This is one of a larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

computing an index of output from primary farming and from the industries that process, manufacture, or distribute farm products. This can rarely be done in terms of physical units because the farm and food system turns out a diversity of products in proportions that change from year to year. Normally it must be done in terms of value units: dollar value of output or sales. If a series of years are involved, confusion between price increases and productivity gains must be avoided by taking price changes into account.

Second, an index must be computed for the costs of the inputs (factors) used to produce the products. Again, indexes computed over time require adjustments for price changes so that an increase (decrease) in the price of a factor of production does not show up as a fall (rise) in productivity. The greatest difficulty occurs in adjusting for quality changes in inputs and/or outputs. Failure to adjust for improvements in the quality of inputs results in overstating productivity gains; failure to adjust for improvements in the quality of products results in understating productivity gains.

When the index of output is divided by the index of inputs, one obtains a productivity ratio. By observing the change in this ratio over time one can calculate the rate of productivity change.

The most common measure of resources devoted to R&D is that of the total expenditures on publicly supported agricultural R&E and total expenditures on R&D by private firms conducting food and agricultural research. To minimize year-to-year variability in expenditures, R&D investment data are collected over a number of years. These time series data may be deflated to allow for increases in the costs of doing research.

The final step is to relate the rate of productivity change to the level of R&D investment or to the change in R&D investment. Since there is a lag between expenditures on R&D and any resulting effect on the farm and food system's performance, it is necessary to lag productivity measures behind R&D measures. The actual lags will vary by industry, product, or problem area, so that the productivity increase in any particular year will be the outcome of R&D conducted at various times in the past.

Economic Benefits from Farm and Food System R&D

Various analysts have attempted to establish the relationship between R&D investments and productivity increases on farms and in industries that process or manufacture final consumer goods from raw farm and forestry products. Researchers have attempted to determine how much of the increases in farm productivity can be attributed to publicly supported R&E investments. Generally these studies indicate that a 10 percent increase in production-oriented R&E expenditures in public institutions results in about a 0.5 percent increase in farm productivity over a 13- to 15-year period, and that these parameters have remained rather stable over time. Even so, public-sector R&E has accounted

for only about one-fourth of the growth rate in farm level productivity in recent years.

Most studies have calculated average and marginal rates of return on public investments in agricultural R&E and on private investments in farm and food system related R&D. Table 1 shows the results of a number of these studies. These rates of return have usually been quite high but they vary widely. Their levels depend on what assumption is made in calculating them: whether the R&D raises the productivity of all capital employed or whether it raises only the productivity of new capital.

Average rates of return to public agricultural research for the aggregate U.S. farm production sector have ranged from near 50 percent annually during 1937-52 to 34 percent annually during 1967-72. Marginal rates of return (i.e., returns on incremental investment) to public agricultural R&E have ranged from 30 to 100 percent for the aggregate farm sector in the U.S. and from 18 to 50 percent for the ten USDA major farm production regions. Almost all of these studies indicate rates of return to public investment in agricultural R&E which are well above the 10 to 15 percent (above inflation) that private firms consider adequate to attract new investment.

Mansfield (1968) has estimated the marginal rates of return to R&D expenditures by firms in four farm and forest products manufacturing and processing industries. In studying the apparel industry, he found that even if the proportion of a firm's technological change not due to its own R&D was as large as 90 percent, the marginal rate of return on its R&D exceeded 15 percent. This finding generally held true for the food processing and furniture manufacturing industries when the R&D raised only the productivity of new capital (i.e., when it was embodied in new capital before affecting productivity).

Public-sector R&E and private industry R&D are not homogeneous; they comprise varying mixes of basic research, applied research, development, and dissemination. The relationship between basic research and productivity gain is remote at best. That between development (or dissemination) and productivity gain is closer in function and time. The major interest in basic research, so far as productivity is concerned, is the role such research has in increasing the productivity of applied research and development and in creating new opportunities to expand society's technological frontiers.

Measures of research productivity on a private industry basis are limited to applied research and development inputs, because in the past private industries have conducted very little basic research. Evenson et al. (1979) analyzed the types of agricultural research done in the public sector and the effects of such research during different time periods. Their results for the periods 1927-50 and 1948-71 provide evidence that a high payoff to science-related (basic) research is achieved only when it is directed toward technology-oriented (applied) research, and that during the period between 1948-71, technology-

Table 1—Summary Studies of Returns to U.S. Farm and Food System R&D.

<i>Study</i>	<i>Industry and Region</i>	<i>Time Period</i>	<i>Annual Internal Rate of Return (Percent)</i>
Peterson and Fitzharris (1977)	Aggregate USA farm sector	1937-1942	50 ^a
		1947-1952	51 ^a
		1957-1962	49 ^a
		1967-1972	34 ^a
Griliches (1964)	Aggregate USA farm sector	1949-1959	35-40
Latimer (1964)	Aggregate USA farm sector	1949-1959	not significant
Evenson (1968)	Aggregate USA farm sector	1949-1959	47
Cline (1975) (revised by Knutson and Tweeten, 1979)	Aggregate USA farm sector (research and extension)	1939-1948	41-50 ^b
		1949-1958	39-47 ^b
		1959-1968	32-39 ^b
		1969-1972	28-35 ^b
White, Havlicek and Otto (1978)	Aggregate USA farm sector (research and extension)	1929-1941	55
		1942-1957	48
		1958-1977	42
		1939-1948	30
Lu, Cline and Quance (1979)	Aggregate USA farm sector (research and extension)	1949-1958	28
		1959-1968	26
		1969-1972	24
		1939-1972	20
	Aggregate farm sector (research and extension)	1939-1972	28
		1939-1972	18
		1939-1972	34
		1939-1972	43
		1939-1972	34
		1939-1972	28
		1939-1972	18
		1939-1972	28
		1939-1972	54
		1949-1959	66-100
		1964-1974	37
		1868-1926	65
		1927-1950	110
		1927-1950	95
Davis (1979)	Aggregate USA farm sector	1948-1971	45
		1948-1971	130
		1948-1971	93
		1948-1971	95
	Farm management and extension	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
Evenson, Waggoner and Ruttan (1979)	Aggregate USA farm sector	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
	Science oriented	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
	Technology oriented	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
Mansfield (1968)	Farm and forest products manufacture R&D	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
	Food processing, capital	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
	Paper products, capital	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
Mansfield (1968)	Furniture, capital	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
	Apparel, capital	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110
	Embodied	1948-1971	110
		1948-1971	110
		1948-1971	110
		1948-1971	110

Source: References for the individual studies may be found in Ruttan, Vernon W., *Agricultural Research Policy*, Minneapolis: University of Minnesota Press, 1982, Chapter 10, except for the following works:

White, Fred C., Joseph Havlicek, Jr., and Daniel Otto, "Agricultural Research and Extension Investment Needs and Growth in Agricultural Production," *Ag. Econ.* 33, Dept. of Ag. Econ., Virginia Polytechnic Institute and State University, Blacksburg, VA., November 1978.

Lu, Yao-Chi, Phillip Cline, and Leroy Quance, "Prospects for Productivity Growth in U.S. Agriculture," *USDA, ESCS, Ag. Econ. Report No. 435*, September 1979.

Mansfield, Edwin, *Industrial Research and Technological Innovation*, New York: W.W. Norton and Co., Inc., 1968, Chapter 4.

^aAverage annual return per dollar of research investment; all other estimates in Table 1 are annual marginal rates of return.

^bLower estimate for a 13-year, and higher estimate for a 16-year time lag between beginning and end of output impact.

^cLower estimate for 90 percent, and higher estimate for 25 percent of the industry's technological change not due to its own R&D.

oriented research improved the productivity of extension education and farm management advice to farmers.

Research paid for in one state increases productivity in other states too, mainly because state boundaries do

not coincide with homogeneous agricultural producing regions. Evenson, et al. (1979) estimated that during the periods 1927-50 and 1948-71 only about one-third of the benefits from science-oriented research remained within

the state conducting the research. For technology-oriented research they estimated that, for 1927-50, only 55 percent of the increase in productivity attributed to technology-oriented research from a typical state was realized within that state. Their analysis for individual states during 1948-51 revealed that for a typical state in the Southern and Western regions, 67 percent of the productivity gains from technology-oriented research was captured by that state. For the Northern region only 43 percent was realized within the state conducting the research.

Ziemer et al. (1982) have estimated the total net benefits accruing to producers plus consumers per dollar of research and extension investment (over a 13-year period) inside and outside of the ten USDA farm production regions. Their results are summarized in the first two columns of Table 2. The ratio of benefits accruing outside the region to benefits accruing within the region is shown as the "spillover ratio" in column three, and the actual ratio of federal-to-state expenditures for the R&E within each region is shown in the last column.

In all regions except the Northeast, the benefits accruing to residents (producers and consumers) outside the region conducting the R&E are at least four times as large as the benefits accruing to residents within the region. The regions with the highest spillover ratios are the Northern Plains (40.10), Mountain (14.85), Delta States (11.65), and Corn Belt (7.32) regions. The Lake States (4.64), Appalachian (4.15), Southeast (4.32), Southern Plains (4.72), and Pacific (4.41) regions have spillover ratios near the national average (4.04) for all regions. A comparison of the ratio of actual federal-to-state expenditures for production-oriented R&E in each region to the spillover ratios for total net benefits indicates that, except for the Northeast region, all spillover ratios are more than double the actual federal-to-state ratio of R&E funding in each region.

Because the distribution of consumer benefits is highly correlated with food purchasing patterns and population distribution, the majority of the total benefits from the R&E flow to those regions (and states) with the high concentrations of population (Fig. 1). The Northeast region receives 38 percent of all benefits which result from the production-oriented R&E investments made throughout the nation. The Corn Belt, Pacific, Appalachian, and Southeast regions are also major beneficiaries of the R&E investments. Each of these regions receives more than 10 percent of the total economic benefits.

Public-sector R&E in the farm and food system also tends to affect relative income differently in various income groups, since tax revenues of federal and state governments are its major source of funding. White, et al. (1982) have analyzed these relative income effects for research in production-oriented agriculture. Family income characteristics for six income categories ranging from under \$5,000 to over \$20,000 annually are shown

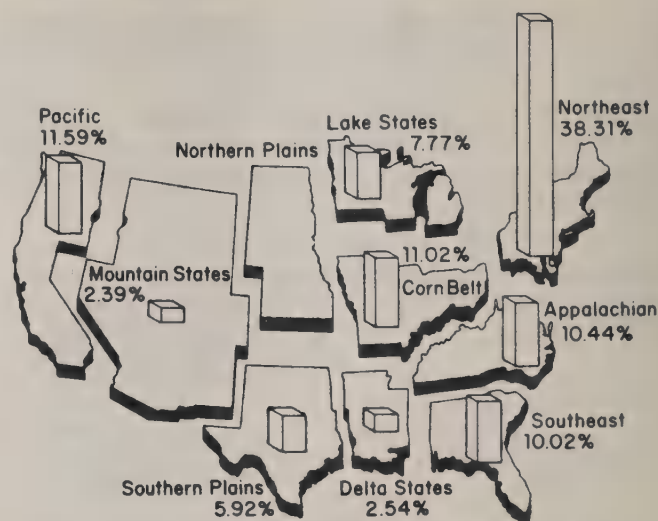


Fig. 1—Regional Distribution of Benefits Resulting from an Increase in Agricultural Research and Extension Expenditures.

Source: Ziemer, Rod F., F.C. White and P.L. Cline, "Regional Welfare and Agricultural Research and Extension in the U.S.," Agricultural Administration 9(1982):175.

in Table 3. The average-sized family ranged from near three persons in the lowest income class to about four in the highest. The distribution of benefits from agricultural research was estimated on the basis of the food expenditures made by each income class. The present value of average benefits per family for the various income classes may be interpreted as the benefits accruing to each family over a 13-year period as a result of the public agricultural research investments in 1974.

Average benefits per family increased with the level of family income; they ranged from \$16.20 in the lowest income category to \$30.74 in the highest. However, the ratio of benefits to family income was about four times as high for the lowest income class as for the highest, indicating that such research has a proportionally greater beneficial effect on low-income families than on high-income families.

The cost of the research, as measured by federal and state taxes per family for production-oriented research expenditures, ranged from \$1.31 for the lowest income class to \$25.60 for the highest in 1974. While benefits and costs increase with the level of income, the tax incidence increases at a faster rate. Therefore, the average net benefits per family declined from \$14.89 for the lowest income group to \$5.14 for the highest income families.

Examining the relationship between public R&E investments and private industry R&D investments and the productivity gains of the various industries within the farm and food system does not reveal many of the national benefits of this research for a number of reasons. Some of the payoff from R&D may take the form of new or improved products rather than more output per unit of input. Such new and improved products may raise productivity in the industries that use them as inputs. Studies of the relationship between R&D and the productivity increase in industry capture

most process innovations but fail to include most product innovations which do not show up as productivity increases in the same industry.

R&D expenditures over a particular time period may overstate the growth in resources committed to advancing technological knowledge and gains in productivity because the resources originally devoted to discovering new knowledge from informal processes and individual inventors (not included in official statistics) are frequently shifted to formal, organized R&D. Even with zero R&D expenditures, inventive activity and some productivity growth would still take place.

R&D investments are not the only source of productivity growth, and R&D and other sources of productivity growth depend on each other. Other factors that influence gains in productivity include progress in organization and management, economies of scale, and improvements in the quality of labor. Improvements in the quality of labor and advances in technology and organization are so intermingled that their separate contributions to productivity growth cannot be distinguished. The main measure of quality improvements in labor is greater educational attainment. But the incremental income associated with education results partly from an improved ability to adapt to new technology. A better educated labor force, in turn, is able to learn more by doing and to adopt new technology more speedily. These factors prevent us from definitely knowing the relationship between R&D and productivity change.

Table 2—Reg. Dist. of the Benefits of Production-Oriented Agricultural R & E Investment.

Region	Total Producer and Consumer Benefits per \$1 R&E Investment ^a		Spillovers to Reg. Benefits Ratio	U.S. to State R&E Expend. Ratio ^b 1949-72
	Inside Region	Outside Region		
Northeast	\$28.39	\$13.14	.46	.97
Lake States	7.93	36.82	4.64	1.10
Corn Belt	5.19	37.95	7.32	1.25
Northern Plains	1.20	47.96	40.10	1.63
Appalachian	8.19	34.01	4.15	1.60
Southeast	7.98	34.45	4.32	1.37
Delta States	3.38	39.38	11.65	1.80
Southern Plains	8.05	37.99	4.72	2.10
Mountain	2.72	40.35	14.85	2.35
Pacific	7.88	34.76	4.41	.90
All regions	\$ 8.62	\$34.84	4.04	1.38

^aDiscounted at 10 percent.

^bIncludes federal funding of production-oriented agricultural research and extension in each region through CSRS, ARS, ERS, SCS and Cooperative Extension relative to state expenditures within the region.

Source: Ziemer, Rod F., F.C. White and P.L. Cline, "Regional Welfare and Agricultural Research and Extension in the U.S.," Agricultural Administration 9(1982):167-178.

Table 3—Relationship of Costs and Benefits of Agricultural Research to Family Income in 1974.

Class	Distribution of Population ^a	Average Size Family ^b	Average Family Income ^b	Average Benefits per Family ^c	Federal Taxes for Agricultural Research per Family ^d	State Taxes for Agricultural Research per Family ^e	Total Taxes for Agricultural Research per Family ^f	Average Net Benefits per Family ^g
	Percent	Persons			1974 dollars			
Under 5,000	18.19	2.93	3,981	16.20	.43	.88	1.31	14.89
5,000-8,000	14.14	3.15	7,922	19.06	1.77	2.05	3.82	15.24
8,000-12,000	21.17	3.28	10,528	20.63	3.19	2.85	6.04	14.59
12,000-15,000	14.47	3.48	13,458	22.13	5.29	3.97	9.26	12.87
15,000-20,000	16.07	3.68	17,371	25.91	8.40	5.59	13.99	11.92
Over 20,000	15.96	3.79	28,953	30.74	15.78	9.82	25.60	5.14

^aSource: Gallo, Anthony E. and William T. Boehm, "Food Expenditures by Income Group," National Food Review, NFT-3, USDA, ESCS (June 1978).

^bSource: U.S. Dept. of Commerce, Bureau of the Census, "Money Income in 1974 of Families and Persons in the U.S.," Current Population Reports, Series P-60, No. 101, U.S. Govt. Printing Office, Washington, DC, 1976.

^cExpressed in present value. Total consumer benefits are calculated according to the equation

$$TB_c = 1/2 \times MVP \times RE \times D$$

where TB_c is total consumer benefits from ag-food research; MVP, is marginal value product of research; RE is production-oriented research expenditures in 1974 (Budget of the U.S. Government; USDA, Inventory of Agricultural Research; U.S. Dept. of the Treasury); and D is the discount factor over 13 years at 10 percent. Total consumer benefits are allocated to income classes according to the level of food expenditures (Gallo, Anthony E. and William T. Boehm, "Food Expenditures by Income Group," National Food Review, NFT-3, USDA, ESCS, June 1978). It was conservatively estimated that one-half of the total net benefits accrued to consumers over the thirteen-year time span.

^dProduction-oriented research expenditures for Agricultural Research Service, Economic Research Service and the federal government's share of State Agricultural Experiment Stations are allocated among income groups according to the distribution of federal personal income taxes (U.S. Advisory Commission on Intergovernmental Relations, 1974).

^eState funded production-oriented agricultural research expenditures are allocated among income groups according to the distribution of state personal income and general sales taxes (U.S. Advisory Commission on Intergovernmental Relations, 1974).

^fSummation of federal and state taxes for agricultural research per family.

^gAverage benefits from agricultural research expenditures per family minus total taxes for agricultural research per family.

Source: White, Fred C., B.R. Eddleman, and J.C. Purcell, "Nature and Flow of Benefits from Ag-Food Research," Office of Technological Assessment, An Assessment of the U.S. Food and Agricultural Research System, Volume II-Commissioned Papers, Part C, April 1982.

Public and Private Funding for Farm and Food System R&D

USDA support for farm and food system R&E programs in FY 1981 totaled \$1.05 billion. For FY 1983 it is estimated at about \$1.2 billion. In FY 1981 about \$200 million of the USDA research funding was distributed to the state experiment stations and other cooperating institutions under various funding authorities. The remaining \$610 million was used for USDA in-house research programs, primarily those of the Agricultural Research Service, the Forest Service, and the Economic Research Service. Most of the \$242 million USDA extension funds were distributed to the state cooperative extension services.

State support for farm and food system R&E programs amounted to \$1.15 billion in FY 1981, with about \$652 million used to support research and the remaining \$498 million allocated to state and local extension programs. Table 4 shows how federal, state, and local funds for R&E were distributed among major program areas.

A recent report by the USDA (1982) indicated that in FY 1981 federal departments and independent agencies other than the USDA devoted some \$581 million to domestic programs related to farm and food system R&E. These were distributed to the major program areas as shown in Table 4. These non-USDA federal expenditures fall into three categories of programs. One category is collaborative and includes programs such as those funded by the Department of Interior on range, wildlife, and hydrology, which are guided by an interdepartmental coordination committee. A second category is supportive and includes programs such as the basic biology and physical science research funded by the National Science Foundation, the National Institute of Health, the National Aeronautics and Space Administration, and the Commerce Department (e.g., Agricultural Weather Service). A third area is USDA mission related, focusing on research and education programs such as those in the Bureau of Reclamation, the Tennessee Valley Authority, the Department of Defense, and portions of programs in other agencies and departments. Only a portion, probably less than one-fourth, of the \$581 million expenditure by these agencies supported either basic research directed specifically to agriculture or technology development for agriculture.

R&D expenditures made by private industry to support the farm and food system are poorly documented. The most recent estimates by Malstead (1980), as reported by Ruttan (1982), indicate that R&D expenditures by private firms in the farm and food input, processing, and distribution industries ranged from \$1.65 to \$1.75 billion in 1979. (See Table 5.) Ruttan suggests that a more complete accounting of private sector R&D which supported agricultural input and food processing and distribution industries in 1979 would show expenditures in excess of \$2 billion. Even though these data are tentative, it is clear that the private sector invested as

much in farm and food system R&D in 1979 as the USDA and state governments combined invested in FY 1981.

Much of this private sector research is primarily focused on product developments which often do not show up as increases in productivity in the firm or industry conducting the research. An innovation in a product such as the materials or equipment used in an industry (e.g., agricultural chemicals or farm machinery) could have a greater effect on the total economy than an innovation in a final product sold to consumers.

Table 4—Public Funding for Farm and Food System R&E in FY 1981.

<i>Program Areas</i>	<i>Research (\$ mil.)</i>	<i>Extension (\$ mil.)</i>	<i>Total R&E (\$ mil.)</i>
USDA:			
Natural resources ^a	209.0	12.5	221.5
Production and protection	364.6	97.7	462.3
Processing, marketing and distribution	113.5	15.7	129.2
People and communities	78.3	116.4	194.7
Agricultural policy	32.4	—	32.4
Unclassified ^b	12.2	—	12.2
Total USDA	810.0	242.3	1,052.3
State and Local:			
Natural resources ^a	105.2	28.4	133.6
Production and protection	442.6	193.5	636.1
Processing, marketing and distribution	58.2	32.8	91.0
People and communities	25.8	242.8	268.6
Agricultural policy	20.0	—	20.0
Unclassified ^b	0.1	—	0.1
Total state and local	651.9	497.5	1,149.4
Federal, Non-USDA:			
Natural resources ^a	187.4	4.0	191.4
Production and protection	100.9	19.2	120.1
Processing, marketing and distribution	63.1	1.7	64.8
People and communities	168.0	35.5	203.5
Agricultural policy	1.4	—	1.4
Total federal, non-USDA	520.8	60.4	581.2
TOTAL	1,982.7	800.2	2,782.9

Source: USDA, Joint Council on Food and Agricultural Sciences, FY 1985 Priorities for Research, Extension and Higher Education, Washington, D.C., June 1983.

^a*Includes soil and water, air, forestry, and range programs.*

^b*Research programs that could not be classified in one of the other five program areas.*

Table 5—Estimates of Private Industry R&D Expenditures for the Farm and Food System.

<i>Program Categories</i>	<i>Millions of 1979 Dollars</i>
Farm Input Industries:	914-1,009
Plant breeding	60-155
Pesticides	339
Plant nutrients	3
(Total plants)	(402-497)
Animal breeding	55
Animal health (mostly veterinary drugs)	99
Animal feed and feed ingredients	133
(Total animals)	(287)
Farm equipment and machinery	225
Processing and Distribution:	734-744
Farm produce transport equipment	45
Food processing machinery	100
Food processing	400
Tobacco manufacturing	40-50
Natural fiber processing	20
Packaging materials	129
TOTAL	1,648-1,743

Source: Vernon W. Ruttan. *Agricultural Research Policy*. Minneapolis: The University of Minnesota Press, 1982, Chapter 8, Table 8.1.

Publicly funded agricultural research is heavily concentrated on program areas which protect, conserve, and manage natural resources and which produce and protect crops and animals. These two major program areas receive about three-fourths of all the public expenditures on farm and food system research done by the USDA and state experiment stations. Such research is heavily concentrated in the biological sciences and related applied technology areas. In contrast, private sector R&D is concentrated in the physical sciences and engineering. These private research efforts were about equally divided between farm inputs and food processing and marketing in 1979.

Private farm input and food processing firms are primarily profit oriented. Such firms engage in R&D which allows them to anticipate the benefits of their efforts. Normally, they focus on proprietary R&D goals so that they can capture benefits through reducing processing and/or marketing costs or by developing new products or processes which can be patented or otherwise kept private. The private firms' educational and promotional activities are primarily designed to produce and sell sophisticated products or product packages. These activities are usually tied to product marketing activities and goals, supporting the use of a firm's product by existing or potential customers.

Policy Issues for Future R&D

Changes in productivity in the farm and food system have been closely related to the accumulation of knowledge in the basic sciences and to the use of that knowledge in the development of applied technologies. Past R&D efforts have accounted for a substantial portion

(but something less than half) of the productivity growth in the farm and food system in recent decades. Future productivity growth must come, in large part, from the discovery of new knowledge. Such knowledge will lead to the creation of new technology and the subsequent management of that technology to the benefit of society.

Policymakers are concerned about how best to plan, fund, conduct, and coordinate the R&D activities of the public sector and the private sector. Fundamental issues include: (1) the optimal level and mix of public funding for future R&E; (2) the roles of the USDA and other federal research agencies, state experiment stations and cooperative extension services, public and private universities, and private industrial laboratories in conducting future R&D activities; and (3) the choice of which R&D programs to advance.

A number of observers have asked whether public support for agricultural R&E is adequate to sustain future productivity growth. This concern has been reinforced by little growth (in constant 1967 dollars) in federal support for R&E through the USDA since the mid-1960's. Total funding for public sector R&E grew rapidly between 1945 and 1965, over 5 percent per year. Between 1966 and 1981, federal support for agricultural R&E increased only 0.6 percent per year. During this latter period nonfederal (state and local government) support grew at an annual rate of 3.1 percent. The resulting combined USDA and nonfederal support to public institutions engaged in farm and food system R&E increased at a rate of only 2 percent per year during 1966-81.

Given the high rates of return on R&E, these slower rates of growth in public R&E expenditures suggest substantial underinvestment in public farm and food system R&E. This lag in R&E funding during the 1966-81 period will affect the future growth rate of the productivity in the farm and food system unless the R&D is picked up by the private sector. Since today's farmers depend heavily on industrial farm inputs, the maintenance of rapid productivity growth in these input industries is important to continued growth in agricultural production. Eddleman et al. (1982) have shown that the rate of productivity growth in these industries has been much lower since 1972 than it had been over the previous two decades. The question now is whether new funding and new people are needed to enable farm and food system R&D to succeed in developing new knowledge and technologies.

A related area of concern is the mix of federal research funding for institutional support (e.g., federal support for agricultural experiment stations on a formula basis) and project grants (e.g., competitive research grant programs). Substituting project grant funding for institutional funding does not necessarily lead to developing better relevant disciplinary science and technology. Nor does it necessarily lead to sustained research in priority research areas. Project grant funding mechanisms are very useful for opening up and supporting new areas of basic or applied research. In-

stitutional support is most productive in sustaining long-term basic research programs for technology development. A substantial portion of the remarkable gains in production achieved in the farm and food system over the two mid-quarters of the 20th century resulted from the fusion of theoretical and applied research. This fusion advanced both knowledge and technology. Grants (competitive or otherwise) from both the public and private sectors and institutional support for public research organizations are both important funding sources for future farm and food system R&D.

Current relationships for R&D among state-level institutions and the USDA in-house agencies and between public-sector and private-sector institutions are in some extent of disarray. This disarray results partly from the way the farm and food system R&D is organized. The federal, state, and private-sector institutions for R&D are a loosely knit network of organizations. The performers in this system possess comparative advantages and disadvantages in creating new knowledge and technologies. The public-sector researchers work within state and federal institutions with varying administrative structures. A state-managed R&D program must respond to needs which farmers and agribusiness people express at state and local levels, but it must also address regional, national, and international policy issues because of the implications these issues have for the farm and food system components within that state. The federally managed R&D programs are directed primarily at regional, national, and international issues, but their findings often affect states and local areas where producers and consumers make their individual decisions. Depending on its size and market, private R&D may address any level of research activity. Distinctions between privately and publicly sponsored R&D programs are based more on who captures the benefits from such programs rather than on whether these benefits are national, regional, state, or local.

In planning and conducting R&D the interests, motivations, and capabilities of all the public and private institutions engaged in farm and food system R&D should be taken into account. This requires close coordination in conducting R&D in order to advance general knowledge and technology development. The question is how to improve interaction among all performers in R&D program development and how to coordinate their work. Unnecessary duplication of R&D effort needs to be eliminated, but productivity in research depends on a certain amount of planned redundancy.

The current tendency is to substitute centralized management and planning for improved coordination and sharing in institutional processes within the public farm

and food R&D system. As central management and planning activities have intensified, the range of new R&D activities undertaken has been narrowed (i.e., priorities have been set on specific R&D programs to be advanced). Considerable caution is warranted in such efforts because we have only limited ability to foresee the direction of technological change which may result from uncertainty in price relationships among inputs (e.g., the real price of energy embodied in farm and food system inputs compared to the prices of other inputs). Changes in input-product price relationships may also influence future technological change. As uncertainty about these future relationships increases, the exploration for new technological alternatives must be kept as diversified as possible. The gains from replication of R&D efforts through the decentralized federal-state-private sector network have more than compensated for any apparent losses due to the redundancy of these efforts. The question is whether it is now time to avoid premature consensus on the R&D opportunities that lie ahead, whether it is now time to encourage parallel R&D efforts.

Conclusion

However, the potential for growth in the farm and food system is not being realized because we are not investing enough in schooling farm people and developing their skills nor in R&D and the dissemination of its results. Decisionmakers in the farm and food system are constrained by a lack of information about worthwhile technological and economic opportunities. Our ability to maintain a competitive edge for farm and food products in a world market depends on continued technological advances. The best efforts of government, universities, and the private institutions engaged in R&D will be required to deliver this new technology. Without such technology, productivity growth in the farm and food system with all the attendant benefits such growth provides for society will lag behind what it otherwise could be.

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Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

The USDA-Land Grant University System in Transition

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THE USDA-LAND GRANT University System began in 1862 at a time when farmers comprised 53 percent of the work force and produced 42 percent of the Gross National Product. Farmers now comprise about 3.2 percent of the work force and produce 2.3 percent of the Gross National Product. Yet in total, the farm and food system is one of the largest sectors of the economy, and it has long provided the American people with a reliable supply of safe food at modest cost.

The institutions making up the USDA-Land Grant University System, the Department of Agriculture, and the land grant universities with their Colleges of Agriculture, Experiment Stations, and Extension Services have been basic forces in helping farmers to achieve today's unparalleled productivity. But can these institutions meet the challenge of the future? Can they provide the basis for a farm and food system that will continue to supply sufficient high quality food at affordable costs even as difficult questions of efficiency, equity, and structure arise? Can they meet the needs of both producers and consumers?

These broad questions must be decided by the American public, preferably with informed assistance from such groups as farmers, food processors and handlers, consumers, and staffs of the USDA and the land grant universities. The broad question might well be considered in the light of a series of questions on critical issues relating to the performance of the system. These include: Who should be served by the USDA-Land Grant System? Should the USDA-Land Grant System have the lead role in agriculture and food? Who should be responsible for basic agricultural research and education? Is natural resource conservation a suitable goal of the system? Should data and information continue to be collected and made freely available? Should farm credit, farm price and income policy, and small community and rural development continue to be government concerns? What can the system do for the consumer and what should it do? These questions are difficult, but the way in which they are answered within the next few years will shape the future of the American farm and food system.

Historical Background

In 1796 President George Washington recommended the establishment of an agricultural branch of the national government and in 1841 the president of Norwich University proposed to Congress that it appropriate funds from land sales to be distributed to the states for establishing institutions to teach agriculture. During the 1840's and 1850's, state legislatures, farm leaders, the editors of agricultural periodicals, and farm organizations, particularly the United States Agricultural Society, urged Congress to act on both of these proposals.

In 1839, Congress appropriated \$1,000 of Patent Office funds for collecting agricultural statistics, conducting agricultural investigations, and distributing seeds. These efforts were continued, even though they were opposed by some groups as being inadequate on the one hand or as representing federal intervention on the other. The matter was settled by the establishment of the Department of Agriculture and the land grant colleges in 1862 as part of an agrarian reform package offered to the voters by the Republican Party.

State agricultural colleges were established in Pennsylvania and Michigan in 1855 and in Maryland and Iowa shortly thereafter. After the Morrill Land Grant College Act was passed in 1862, every state accepted its terms. As states were established, each one received grants.

State agricultural experiment stations had been proposed as early as 1845, although general interest in them was not as great as in colleges or a federal department of agriculture. Connecticut and California established stations in 1875. This stimulated further interest and a number of farm organizations and conventions passed resolutions urging both federal and state governments to provide aid for such stations. Finally, in 1887, the Hatch Act became law. The new law provided for a yearly grant to each state for the support of an agricultural experiment station. Within a year, every state had accepted the provisions of the act.

The USDA, the land grant universities, and the state experiment stations all had to win public support. Some farm organizations and farm journals were critical,

Don F. Hadwiger, Iowa State University, and Lee Kolmer, Iowa State University, contributed reviews of the paper. This is one of a larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

charging mainly that the new institutions were theoretically oriented and not related to the real problems of farming. However, as members of these institutions created realistic solutions to some of the problems faced by farmers, these criticisms abated. For example, Stephen M. Babcock, a chemist at the Wisconsin Experiment Station, devised a simple, accurate test for determining the quantity of butterfat in milk. This non-patented testing system permitted dairy farmers to sell their milk and cream on a rational basis.

The USDA, the land grant universities, and the experiment stations faced problems of coordinating their efforts. One step in coordination came in 1887 with the organization of the Association of American Agricultural Colleges and Experiment Stations. Another came a year later when the Office of Experiment Stations (now the Cooperative State Research Service) was organized. These organizations provided the basis for the rapid expansion of agricultural research.

Research was of little use until it reached the persons it was intended to serve. After various means of disseminating information had been tried, Congress established the Cooperative Extension Service by the Smith-Lever Act of 1914. The Extension Service has become one of the most widely copied American governmental institutions. Nevertheless, observers are now raising questions as to whether or not it has outlived its usefulness, particularly at the national level.

Until the 1930's, the USDA, the land grant universities, the Association, and the Cooperative Extension Service comprised an influential block of institutions devoted to research and education. Then the Great Depression threatened the entire structure of American agriculture. As a result, a "new" department of agriculture was built upon the old.

Congress and the President charged this new department with taking an active part in the economic well-being of American farmers. The Agricultural Adjustment Act of 1933, the Soil Conservation and Domestic Allotment Act of 1936, and the Agricultural Adjustment Act of 1938 were the key legislative acts during this time. The 1938 act, with many modifications, is still in effect.

The U.S. government started a federal crop insurance program. The Soil Conservation Service worked with farmers to control soil erosion and it now also helps in water conservation. The Farm Security Administration, now the Farmers Home Administration, was established to help farm tenants become owners and to make loans to small, high-risk farmers. The Farm Credit Act brought various farm loan programs into a unified operation. The Rural Electrification Administration aided local cooperatives in bringing electricity to farms. A number of laws, the first ones emergency in nature in 1933, allocated surplus commodities to feed America's

hungry and aided school lunch and school milk programs.

Since the 1930's many of the New Deal programs have been modified, yet nearly all of them are still in effect. During the 1950's, the USDA placed a new emphasis on exports. Under Public Law 480 of 1954, surplus farm commodities could be used to help the developing nations, but in recent years the government has placed more emphasis on commercial exports.

Some of the New Deal economic programs led to conflicts between the USDA and some of the land grant universities when the universities claimed that the New Deal legislation was aimed at changing the structure of American farming and that its programs were being administered without proper consideration of their role. The problems were solved, at least in part, by reaching clearer understandings as to the responsibilities of each of the institutions.

Current Criticism

A changing perspective on farm and food programs and institutions has resulted largely from first, a questioning of the focus of agriculture programs by outside critics and second, criticisms of the focus and quality of the programs from sources within the agricultural community. Rachel Carson, in her book *Silent Spring* (1972), and Jim Hightower, in his *Hard Tomatoes, Hard Times* (1973), both argued that the USDA-Land Grant College System was directed too narrowly to plants, animals, soils, and farm prices to the neglect of problems of small farmers, rural communities, and consumers. The hunger lobby, composed of organizations such as Bread for the World, has argued that not enough attention has been focused on hungry people in this country and other parts of the world. As the USDA-Land Grant System has given some attention to the problems of the environment, international hunger, consumers and rural communities, the organizations concerned with commercial agriculture have become increasingly critical of this attention. These organizations argue that the role of the USDA-Land Grant College System is to serve the needs of farmers and the food system.

The integration of the U.S. food and fiber system with the general society and with the international community has increased. Approximately every third acre of U.S. grain production is exported. Economists suggest that monetary and fiscal policy have more impact on farm prices and income than do traditional price and income policy. Today both food and agriculture questions must be checked and even cleared outside of the USDA-Land Grant System. The Department of State, the Defense Department, the Department of the Treasury, the Office of Management and Budget, and the White House are all concerned with agricultural exports and

the costs of food and farm programs from one point of view or another. In addition, the Department of Health and Human Welfare, primarily through the Food and Drug Administration and the National Institutes of Health, and the Environmental Protection Agency concern themselves with the quality and safety of food. Even the relatively new Department of Transportation is involved with the difficult problem of getting grain from where it is grown to ports for shipment abroad. Some critics of the USDA-Land Grant College System argue that it is controlled by the agricultural establishment and will not respond to the needs of the rest of society, thus necessitating the involvement of these other agencies.

Ultimately, the American people must decide which institutions should help them to meet their needs for food and fiber and what each of these institutions should do. This paper now focuses on issues and alternatives for future changes in the basic institutions that have undergirded our farm and food system.

Who Should Be Served by the USDA-Land Grant System?

When it was established, the USDA was viewed by farmers and by the rest of the nation as "The Farmers' Department." Farmers saw agriculture as the key industry upon which the well-being of the nation depended. Thus it seemed that the nation as a whole would benefit from the USDA's service to farmers. The land grant universities were originally called "The People's Colleges." A large number of the people in the U.S. of a century ago were farmers; thus it seemed appropriate that these universities serve farmers and agriculture.

However, the economic and social structure of the United States has changed drastically in the last 100 years. Farmers now account for less than 4 percent of the population. Approximately 125,000 farms produce half the value of total farm production. With the development of agribusiness, many of the inputs such as fertilizer, seeds, feed, and credit come from off the farm. Marketing services formerly provided by farmers such as food processing, transportation, wholesaling, and retailing are now done off the farm. Farmers and their hired workers make up only 13 percent of all the people in the food and fiber system and farming contributes only 12 percent of the value of these products at the consumer level. When the USDA and land grant universities were established, most of the agricultural products produced were used domestically. Today the U.S. comparative advantage in farm production has been rediscovered. The U.S. supplies nearly 50 percent of all the wheat, corn, and two-thirds of all the soybeans in international trade. Agriculture is no longer isolated from world market forces.

U.S. agriculture has lost its uniqueness as former

Assistant Secretary of Agriculture Don Paarlberg points out. During the 19th century, Americans perceived agriculture as uniquely worthy and considered farmers to be good citizens. Thus they felt that a high percent of the population should be on farms. Farming was considered not only a business but a way of life. During the past three decades, farm people have become part of an industrial urban economy. They are no longer readily distinguishable from nonfarm people. The institutions set up to serve a unique farming population have brought about the unforeseen consequence of helping to reduce that uniqueness.

Groups other than farmers and the agricultural establishment have become interested in, and concerned about, the activities of the USDA and land grant universities. These new groups are concerned about the price, safety, and nutritional content of food, ecological questions, rural development issues, land and water use issues, civil rights, occupational safety and health, and collective bargaining for farm labor.

As the farm economy has become more integrated with the total economy, the influence nonfarmers have on agriculture has increased greatly. But the importance of the farm economy to the nonfarm economy has also continued apace. The steadily increasing productivity of the U.S. food system has significantly reduced the number of hours a U.S. nonfarm worker must spend earning sufficient funds to pay for food.

All of these changes, as well as many concerns not mentioned, raise the question of who should be served by the USDA-Land Grant System. The farmers and the members of the agricultural establishment argue that the welfare of the entire country is improved if it serves them. Consumers, rural residents, and people on the fringe of agriculture argue for more attention to their needs. It can be argued that instead of a Department of Agriculture, a Ministry of Food is needed to serve the total nation. In many countries of the world the comparable ministry or department is one of food and agriculture. Thus the fundamental question facing the USDA-Land Grant College System is: Who shall be served and how? Should more attention be given to the nonfarm part of the food system? After all, labor efficiency in food retailing has more to do with food prices than does efficiency in farming. Such areas are almost totally neglected by the USDA and the land grant universities, perhaps because the private businesses may be more actively working on these problems or because it has not been traditional to consider such questions. Can consumers best be served by serving farming and the nonfarm parts of the food system? Can agriculture be served by the system focusing attention on the problems and interests of consumers? In many of the issues there is not a conflict or tradeoff, especially in the long run, between serving the agricultural establishment and the

citizens of the nation. However, in the short run conflicts and tradeoffs do occur.

What may be needed is for both the agricultural establishment and its critics to recognize areas of mutual agreement about the USDA-Land Grant System. When there is conflict in the short run, perhaps the principle for dealing with that conflict should be to do what is in the long run interest of the nation in maintaining the supply of farm products needed rather than to do what is in the short run interest of farmers, the nonfarm part of the food system, or consumers.

Should the USDA-Land Grant System Have the Lead Role in Agriculture and Food?

When the USDA and land grant colleges were established over 100 years ago, no one questioned that they would have the lead role in agriculture and food programs. But the growth in interrelationships between agriculture and the rest of the economy, the declining number of farmers, and the significance of agriculture in international markets have raised the question of whether the system should retain its lead role.

The question of who should make major policy decisions for agriculture and provide services for it is a constant and daily source of conflict. Issues such as the use of land and water for agriculture are influenced by groups and agencies concerned about the environment and the use of natural resources. Policies that influence the level of exports and the prices of food and other raw materials affect many groups in the economy and many government agencies. It has been suggested that current leadership for policy decisions affecting agriculture cannot come from the USDA-Land Grant System because these policy decisions are so important to the well-being of the nation. However, the traditional agricultural establishment argues that without such leadership, society risks losing the benefit of the USDA-Land Grant System's service to the nation.

Which policy issues and services should be concentrated in the USDA-Land Grant System? Clarification of this issue would enable the USDA-Land Grant College System to operate more effectively. Officials now expend much effort on turf protection and jurisdictional disputes. Thus counterproductive efforts abound. Resolving this issue is closely related to resolving the question of who should be served by the USDA-Land Grant College System.

Science and Education

Agricultural science and education depend largely upon government support and direction. Neither farmers nor consumers have the capacity to do the required research or extension individually or to organize and finance agricultural science and education collectively. Science and education have contributed to substantial increases in agricultural productivity

resulting in great benefits to consumers. This productivity, however, has led critics of research and extension to charge that increasing farm productivity aggravates the problem of the surplus.

Science and education as carried out by the land grant universities and the Department has also been attacked over the past several years by scholars and others for lack of innovative lines of research, emphasis upon applications of science and technology rather than upon basic research, and too much concern with industry-oriented work. Other critics have said that research and extension is directed primarily at the large commercial farms, with little or no attention being given to the needs of the small and moderate-sized farms or to the other parts of the food system. According to some critics, the science and education system is committed to increasing production without regard to other effects, for example, the possible longtime effects of chemicals on human life or of large machines on soil erosion.

A number of issues exist regarding science and education. Is the level of funding adequate? Research on the payoff from public funding of science and education suggests returns on the order of 30-50 percent. This is much higher than the returns from other major programs of government. It suggests that government is seriously underinvesting in support of these activities. Why has there been such underinvestment? Possible answers to that question are complicated. One answer concerns the partial funding of research and extension by states. The benefits and costs are computed on a state by state basis and not on a national basis. This may lead to underinvestment by individual states.

Another answer to underinvestment may lie in the controversy over whether and when growth in agriculture productivity resulting from research and education benefits producers rather than consumers. Political groups representing farmers have been the major element in supporting agriculture science and education. If the demand for farm products is growing rapidly, as when exports are expanding, producers may retain a relatively large share of the gains from new innovation. If the demand is growing slowly, as was the case in the United States during most of the last 50 years, a larger share of the gain will be passed on to consumers in the form of lower commodity prices. Until the 1970's demand was growing slowly; indeed, the major policy issue was surplus agriculture production. Underinvestment now may be the legacy of the commodity surpluses of the 1930's to the 1960's.

But if consumers were the primary beneficiaries in the last few decades, why did they not insist on increased investment in research? Perhaps it is because the benefits to the individual consumers are cumulative and relatively low from one year to the next and are distributed over all consumers, and because consumer groups have not organized to dramatize this issue.

The role of federal agencies other than the USDA in financing agriculture, science, education, and information is important. Along with funding goes control of the programs. Should more or less of the agriculture science and information be funded from agencies other than the USDA in order to better serve the needs of the consumer and the nonagricultural establishment interested in agriculture?

The issue of the role of public vs. privately supported agriculture research and education also exists. How much science and education should come from privately funded sources rather than publicly funded sources? Many input firms and marketing firms now provide much of the new technological development directly to farmers and the food system. Many people in private firms are increasingly critical of the publicly funded system of agricultural science and education. On the other hand, many observers would argue that the private system works only on marketable products.

Related to the public funding of the system is the issue of which level of government should provide what. Currently many take the position that the federal level funds should be predominately used for basic training, research, and education, and that the state and local levels of government, along with the private firms, should provide the applied science and education. What is the federal role in science and education? Clearly private funds will not be used unless there is the opportunity to relate to a patentable or branded product. Would limiting federal support to that of basic work yield sufficient innovation to benefit the consumers and other interests in the use of agricultural resources? By whom, how, and to what extent should the agricultural research and education system be coordinated?

It is clear the funding and operation of the agriculture science and education system will be different in the future. The major beneficiary of this system will not be the agricultural establishment itself, although the system will be important to it, but the nation as a whole. These complex and subtle policy issues and questions need dialogue and action.

Other Challenges

The roles of the USDA and the land grant universities are being questioned in many areas. During the past fifty years, this system has been charged with major responsibilities for soil and water conservation, farm credit, farm price and income policy, small community and rural development, food distribution, and food safety. But, as in science and education, many of these responsibilities are eroding. For example, the Farm Credit Administration, which was part of the USDA from 1939 to 1953, is now an independent agency, while the Commodity Futures Trading Commission became independent in 1974. Proposals for transferring other

functions, particularly those relating to food distribution and forestry, are made regularly.

A somewhat different situation, but one which is quite relevant, has arisen regarding the agricultural role of the land grant universities. In many of the major land grant universities the number of students, the number of faculty, and the funds devoted to agriculture are substantially less than those devoted to the arts and sciences, a situation far different that it was prior to World War II. Much basic research related to agriculture is no longer being carried out by land grant institutions and the value of Extension is being questioned. Although some institutions have recently reported an increase in the number of enrollments in agriculture, the problem is still serious. Declining enrollments in agriculture will lead to declining support.

These changes bring us to two key questions. Is the USDA-Land Grant University System as we know it obsolete? Must it be redesigned if it is to meet the needs of the future? Recent actions and proposals point up these questions. The National Science Foundation, for example, organized in 1950, has more funds to allocate for basic plant science research than does the USDA. Many of its research grants are not being made to the land grant universities.

In 1971, President Richard M. Nixon proposed abolishing the USDA and allocating its functions to a number of new departments. Earlier, Secretary of Agriculture Orville L. Freeman advocated reorganizing the USDA as the Department of Food and Agriculture, while others have suggested major reorientations in the functions of the Department. Later, President Jimmy Carter indicated that he might propose major changes or even the dismemberment of the department as well as of other cabinet posts. The fact that such proposals have been made for almost two decades suggests that there is a questioning of the department's organization and of the department itself.

President Nixon's proposal was that the USDA be abolished and that its functions be divided among four new superdepartments, which would replace seven Cabinet posts. The new departments were to be Natural Resources, Economic Affairs, Community Development, and Human Resources. No general farm organization supported the President's plan and most opposed it. The agricultural committees in the Congress also expressed opposition to it. Late in the year, the President announced that he had concluded that it was necessary to have a separate Department of Agriculture. Peripheral activities would be transferred to other departments and the Department of Agriculture would concentrate exclusively on problems involved in serving the farmer. Such transfers never took place.

During 1977 and 1978, President Carter had a reorganization staff at work. Although there were rumors that the USDA would be abolished, the staff finally

recommended that the USDA be reorganized into a Food and Agriculture Department. A number of substantial functions would be transferred to the new agency from other departments. Actually, nothing was done. Earlier, the Secretary had consolidated several agencies into larger groupings that, from the perspective of a few years later, were quite ineffective in improving program management. These consolidations were reversed in the early 1980's.

Thus although there have been many proposals for major changes in the USDA in recent years, none have yet become effective. Almost every agency and program of the department is supported by some legitimate interest or pressure group. At the same time, the USDA and the land grant universities have been sufficiently effective in meeting public needs in food and agriculture that there has been no obvious support for major attacks on the system.

Nevertheless, it is reasonable to assume that public support will continue to erode if the system, particularly the USDA, attempts to confine itself to serving the farmer. There are not enough farm Congress members to carry through major legislation without at least some urban support. Thus several Secretaries of Agriculture have taken office determined to return the USDA to the farmers, but soon found that food stamps had to be included in farm legislation to get it through the Congress.

These shifts and threats of shifts, even though mostly ineffective, portend additional questioning of the traditional USDA-Land Grant University System. At the very least, the system will be pushed in the direction of accommodating the nation's interest in food as well as in farming. The system's clientele will include the consumer as well as the producer, the urban resident as well as the farmer. At the other extreme, the USDA will be abolished, with its functions dispersed to other agencies, and the Colleges of Agriculture will lose their identities, with their courses of instruction being merged into those of the Colleges of Arts and Sciences and of Engineering.

Summary

The USDA-Land Grant University System has helped to make American agriculture probably the most pro-

ductive in the world. The American consumer has been the major beneficiary, spending a smaller percentage of take-home pay for food than the consumer in any other industrial nation.

The system began when farms and rural interests together comprised the dominant component of the American economy and of American society. Over the past 130 years, the role of the system has diversified from its initial emphasis on education and improving agriculture to concerns with natural resources and environment, community development, international trade and development, general economic and international policy, market system operation, and consumer welfare.

Today, farms and rural interests are a small component of the economy and society. The USDA and land grant universities provide research data and information that assist both government and the private participants in the food and fiber system. The USDA administers publicly supported programs dealing with farm price and income; conservation, natural resource, and environmental programs; and farm credit programs. The USDA and state institutions develop the "rules of the game," including grades and standards, commercial procedures for buying and selling livestock and other commodities, and regulations to enhance the safety and quality of food.

Shortly after President Abraham Lincoln signed the law establishing the USDA, he called it "truly the people's department." But today the USDA and the Land Grant University System is under attack. It is said to be too narrowly focused on production, giving little regard to some of the impacts of its research and programs on economic and social structure and on natural resources. Its research, critics say, has been diverted from questions of fundamental importance to the nation's future to applications of technology.

The many questions that have been raised in this review can be summarized in one basic question. Is the USDA-Land Grant University System worth preserving and, if so, how can it better meet the nation's needs? The future shape of American agriculture and the well-being of the nation may depend upon how this question is answered.

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

Genetic Engineering & the Future of the Farm & Food System in the U.S.

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NEARLY EVERYONE agrees that technological advances are essential to the future of agriculture and the consumers of agricultural products. Yet it is uncertain whether our past rate of technical innovation can be sustained, let alone accelerated. On the other hand, large innovations can cause income and adjustment problems in the development of some products. Thus public policies which affect the pace and direction of technical innovations are of urgent concern.

One area in which researchers are seeking to increase the potential for productivity gains is the new biotechnologies, which include genetic engineering. In agriculture, these new biotechnologies possess an as yet undefined potential for increased control and improved techniques in processing and manufacturing new plant and animal products. For example, scientists are expressing great interest in the use of recombinant DNA techniques and protoplast fusion to provide the capability for the transfer of genes between plants, between animals, or even from animal to plant. It may be possible to bring together populations of genes for which natural barriers to sexual reproduction currently exist. It may be possible to engineer plants with such characteristics as nitrogen-fixing abilities, resistance to bacteria or viruses, salt and drought tolerance, and perennality. Other future possibilities include pesticides and herbicides which can be used to prevent specific diseases or pests, vaccines, plant and animal growth hormones, and fertilizer replacements. Or it may be feasible to use industrial processes (e.g. fermentation) to produce foods which were formerly obtained from field agriculture.

Biotechnology in general, and genetic engineering in particular, currently suffer from exuberant media attention, which has led to much speculation about results of current research. This is due, in part, to the large sums of capital invested in new biotechnology and in part to the confusing use of the terms "biotechnology" and "genetic engineering." Biotechnology is *not* a discipline but a field of activity suitably defined as "the application of scientific and engineering principles to the processing of materials by biological agents to provide

goods and services" (Bull, Holt and Lilly, 1982). Examples include sweeteners and protein synthesized by bacteria as well as field production of food, fiber, and industrial feed stocks. Genetic engineering is *not* biotechnology, but is the scientific development of techniques for genetic manipulation which will have a substantial impact on biotechnology. Observers are most uncertain about the outcome of this research and development (R&D), in particular about what can be realistically expected in the nature of technological changes and what effect these changes will have on the farm and food system.

This paper illustrates some of the potential changes in agriculture, agribusiness, and the universities. It focuses on the institutional changes and policy issues which cause technological change as well as on those which react to such change.

Some Constraints

It is not the intention here to discuss the technical aspects of the new biotechnologies, which are discussed elsewhere (Bull, Holt and Lilly, 1982, Brill 1981, Barton and Brill 1983, OTA 1981). However, it is appropriate to point out that major technical constraints currently limit the full realization of these new technologies.

For example, scientists do not fully understand how to identify genetic functions and link them to agronomic traits because of the complex dynamic interaction between the genetic materials of various crops (Barton and Brill, 1983). Success with simple microorganisms does not imply equal success with higher plants and animals. According to Brill (1981), what appears to be possible in theory is proving extremely difficult in practice.

Expected Production and Institutional Changes

It is important to recognize that discussion of the impact of genetic engineering on the future of the farm and food system is essentially speculative. It hasn't happened yet! In particular, it should be remembered that statements which reflect negatively on potential changes

Peter Carlson, Crop Genetics International, and James Nielson, Oregon State University, contributed reviews of the paper. This is one of larger set of resource papers sponsored by the Extension Committee on Policy (ECOP), USDA-Extension, Michigan State University Cooperative Extension Service, and the various universities and organizations that supported those who have contributed papers and reviews.

do not necessarily imply that the technology itself should be viewed negatively. Rather, these statements represent possibilities which should be taken into account when changes in institutional structure are considered.

Changes in Agriculture

Because the U.S. food system is so complex and diverse, it is extremely difficult to measure the magnitude or direction of the effects of breakthroughs in biotechnology. Current expectations of new types of plant life which can, for example, biologically fix nitrogen, may have a tremendous effect on the demand for nitrogenous fertilizers, natural or man-made. Plant life which is genetically adapted to resist bacteria or viruses, to tolerate salt, drought, or cold, or to retain immunity to pesticides may affect the costs of inputs and location of production. Plant life which is genetically engineered to be perennial, or plants with increased photosynthetic efficiency or increased hybrid-vigor may affect the magnitude of production. The possibilities of producing energy-crops at levels which make them cost-effective may further reduce input costs.

Biotechnology is already making large inroads into animal research. One example of a newly developed biotechnology is bovine growth hormone (bGH). Depending on the stage of lactation, 44 mgs. of bGH injected into a dairy cow daily can be expected to result in a 15 to 40 percent increase in milk production, regardless of the cow's normal production level (Kalter, 1983). Another example is the development of embryo-transfer. It is now possible, and is becoming widely acceptable, to transplant live embryos of championship, high quality dairy and beef cattle to recipient cows in order to gestate and produce genetically superior cattle. Through cryobiology, these embryos may be stored and transported for use at any time and any place in much the same way that semen has been stored and transplanted for years (Brotman, 1983).

Technological change has been the dominating factor in changing the structure of agriculture. According to recent projections to the year 2000 by Lin, Coffman, and Penn (1980), the proportion of large and small farms will increase and the proportion of medium-sized farms will decrease. Land ownership will be dominated by fewer farms, and by the year 2000 the largest 1 percent of farms will account for about 50 percent of total farm production. About 50 percent of the farm land will be farmed by the largest 50,000 farms and about 2/3 of the wealth in the agricultural sector will be in the hands of the top 20 percent of farmers. If anything, breakthroughs in biotechnology will simply accelerate this trend. For example, it is estimated that the development of bGH alone suggests that our national dairy herd may need to be reduced to 60 to 70 percent of its

current size by the year 2000 if bGH is widely adopted (Kalter, 1983).

Overproduction is another problem which has plagued U.S. agriculture. Increasing agricultural productivity so that resources can be used more efficiently elsewhere is a desirable goal but it creates a problem if it continues to be a source of instability in agriculture. According to many authorities, there is no known physical or technical reason why basic food needs cannot be supplied for *all* the world's people in current technology. These needs are not now being met because of social and political structures and values *not* because of physical scarcity (OTA, 1982).

Changes in Agribusiness

Agribusiness comprises the support industries which service agriculture. It includes all of the marketing and distribution functions which take place beyond the farm gate, including those industries which supply agricultural inputs.

On the input side, the development of a new genetic engineering industry is underway. The proprietary possibilities of biotechnological research have encouraged the development of about 200 new firms. Many of these are small enterprises funded by venture capital. Others are owned or were established by large multi-national petro-chemical and pharmaceutical interests who have also been buying seed companies. Speculation about the potential for genetic engineering has contributed to many mergers and takeovers of seed companies. Changes which occur in the engineering of new plants will be expressed and distributed in the seeds of such plants. Thus any firm or corporation which intends to invest in the new biotechnologies may be at a distinct advantage if it can market its products through an established seed company. There are also other reasons for such mergers. For example, there are obvious compatibilities between resource uses in genetic engineering in general and in the seed industry. There is also the possibility of making unique combinations of plants and accompanying pesticides and herbicides. An integrated firm may develop varieties that are productive only if its brand of pesticide or herbicide is used as well. Other input industries which may be substantially affected by breakthroughs in the new biotechnologies include the manufacturers of fertilizers, pesticides, farm machinery, and feed stocks. In addition, it can be expected that the biotech firms themselves will create the need for support industries to provide them with supplies of various sorts.

On the output side, changes will occur as new agricultural and food products are developed. Artificial sweeteners are a current example. Processing and manufacturing energy-producing substances may substitute for processing oil and coal. An assessment of the ecological consequences must precede the large scale development

of these industries so that we can avoid previous mistakes of ecologically damaging dependencies on oil, coal, and chemical substances.

Changes at Universities

The private sector's demand for highly trained genetic engineers has created a shortage of personnel at universities. This shortage could threaten the long term viability of biotechnological research. At a time when more personnel need to be trained, universities lack the faculty members to do such training.

The seed industry is pressuring the universities to reduce their role in the release of finished varieties and to restrict themselves to basic research. Some universities for example have reduced or eliminated their corn breeding programs. If universities are not involved in the whole process, how can they maintain their expertise in teaching? The USDA is reducing its breeding research and its role in coordinating the state experiment stations.

Generally speaking, industry has supported increased cooperation between private and public sectors but the potential for conflicts has prevented total integration of public and private biotechnological R&D. For example, conflicts may occur if private industry demands increased influence over public research agendas and increased control over the dissemination of research results which have proprietary potential. Conflicts may also be aggravated as certain land grant universities rely more on private funding and royalties and less on public funding, and as the competition for prestige between universities increases.

Changes at the Federal (Legislative) Level

Changes in legislation affect institutional structure. The recent announcement that the EPA has decided to take over the regulation of the genetic engineering industry is likely to influence considerably the type of legislative changes on the horizon. While many of the products of biotechnology will not require special regulation, the EPA's primary task will be to ensure environmental safety. It will therefore influence the regulations which are an important part of the biotechnical research industry's institutional structure. The industry is split in its opinion of EPA involvement. Some researchers believe that the sooner regulatory guidelines are set down, the sooner they will be able to go ahead with manufacturing new products. Others believe that there is little need for regulation because many of the products will be common pharmaceutical and agricultural chemicals.

Similarly, health and safety standards of rDNA research are also strict but mostly voluntary. As private research firms increase their participation in rDNA R&D, they are likely to bring pressure to bear for relaxing these standards. The current arrangements for trans-

ferring licenses on patented/protected material from universities to commercial enterprise are in a state of flux. Some private firms object to being excluded, but others argue that they can't afford to develop and market a new product without exclusive rights.

Finally, the passage of the Plant Variety Protection Act (1970) and the 1980 Supreme Court decision (in re *Diamond v. Chakrabarty*) to allow patenting of life forms under Section 101 of the Patent Act have nominally increased the protection available to the seed industry and the genetic supply industry. However, members of both industries are expressing considerable discontent with the current laws, fearing they may not provide a level of protection commensurate with investment in R&D. Thus there may be increasing pressures on government to tighten or change some aspects of the patent/protection laws.

Policy Issues for the F&F System

Public vs. Private Research

It is becoming increasingly popular for universities to sponsor conferences which explore university-industry relations. The most widely publicized of these was the Pajaro Dunes, California, meeting in May, 1982, which was attended by the heads of 5 major research universities and 11 corporations involved in biotechnological research (Culliton, 1982). Participants in these conferences express concern about potential conflicts between private sector objectives and public research agendas. This concern is summed up in a sentence from a statement released at the Pajaro Dunes conference:

... research agreements and other arrangements with industry [must] be so constructed as not to promote secrecy that will harm the progress of science, impair the educational experience of students and post-doctoral fellows, diminish the role of the university as a credible and important source, interfere with the choice by faculty members of the scientific questions they pursue, or divert the energies of faculty members and the resources of the university from primary obligations to teaching or research.

The issues are both complex and contentious. According to Hess (1982), the real problem with biotechnology is that capital is invested in ideas rather than in a physical product. If proprietary rights are established, then the discussion of the idea amongst interested faculty ceases since it becomes a secret. This barrier is exacerbated if faculty members have equity or financial interest in the capital invested in the idea. As a result individual faculty members often alienate themselves, neglect their duties and their graduate students, and may decide to leave the university for the larger financial gains available in the private sector.

Many universities have a policy of accepting private

grants only if they fit into ongoing research for which a place on the agenda has been established by other criteria. However, the problem is likely to be exacerbated because of the increased involvement of a wider spectrum of university departments in biotechnology, and because of private industry's aggressive search for solutions to technical constraints and potentially large financial rewards.

Private firms are also concerned about these issues because they rely on much of the basic research carried out at universities. Many firms cannot afford to invest the capital resources needed to do this basic research themselves. Another problem also arises as federal support for graduate training and research declines. Universities have often viewed the private sector as a possible source of additional financing. However, if universities establish policies that aggressively exclude private sector involvement in research, then the private sector will have little incentive to fill the funding gap which is developing.

Apart from the concerns of the university and industry, a third perspective—the public concern—is also relevant. There is much debate about who owns publicly funded research and about whether or not everyone has free access to all of the ideas (Bouton, 1983). When private grants are made, the researchers involved often use publicly financed equipment and build their research on publicly financed knowledge, which makes claim on any final point product hard to determine.

Patent Issues

Currently there are two legal mechanisms for protecting an invention. One way is to make use of the protective institutions of the Plant Variety Protection Act (PVPA of 1970) for sexually propagated plants, the Plant Patent Act (1930) for asexually reproduced plants, and/or the Patent Act for any life form. The second way is to rely on that body of common law which governs trade secrets.

As already mentioned, members of the genetic supply industry have expressed some discontent about the ineffectiveness of the current protective laws. A major problem is the fact that an application for a patent on a process requires information about this process. If such information becomes public, as is usually required, it provides enough information to competitors to make the patent ineffective, i.e., competitors can create a near substitute. The general intent of the patent laws, and of the additional protective legislation for plants, is to induce inventors to make their ideas available to the public so that these ideas can be further improved for societal benefit. In return the inventor is granted exclusive ownership and control of the present invention. Trade secrets, on the other hand, (derived from common law and not specifically created by statute) are protected as a right by the courts, but do not require public

disclosure of information. However, an individual or a company relying on trade secrecy to protect an invention is responsible for the security of the secret. Thus the trade-off between trade secrets and patents becomes one of deciding what is to be protected and at what cost.

The discontent with these alternatives becomes obvious. Researchers in genetic engineering firms who want to protect their findings want both legal protection *and* nondisclosure. Under current legislation, however, it is not possible to acquire both of these forms of protection.

There is, however, a third alternative. It is possible, particularly in plant breeding, to breed as an end product a hybrid or hybrid-like product which will not breed true to form in the ensuing generations. These unique products have their own natural protection system since the inbred parents are relatively easily kept as proprietary material (even secret, at a relatively low cost), and because it is not possible to reproduce the special qualities of the F1 hybrid without access to the inbred parents.

The hybrid prevents the farmers from growing their own seed (Schmid, 1984 and Berlan, 1981, 1982). If institutions can't provide exclusivity and return to research, breeders may adopt hybridization even if it is not otherwise the best approach to varietal improvement. Thus institutions may unwittingly shape the research agenda.

Another current potential problem in the pesticide industry, one which could affect the biotechnology industry, is the length of time it takes to get EPA approval. At present, it takes about 7 years to get approval from EPA for pesticides. Since the life of a patent is 17 years, this leaves a firm only 10 years to recoup its investments, which may be insufficient. If health and environmental regulations are applied to the biotechnology industry, this difficulty is likely to create discontent and pressure for change.

The issues here require clearer definitions of property rights. Is it possible, for example, to design a protective mechanism which will provide firms opportunities to recover their investments, while at the same time ensuring that patent claims cannot be misconstrued and that the legal monopoly granted will not result in a complete deterioration of market forces?

Industrial Market Concentration

The takeovers and mergers in the seed industry over the last decade, together with the increase in the relative prices of seed and the establishment of patent-like protective institutions such as PVPA and extension of the Patent Act, have triggered considerable concern about the possibility of substantial market concentration occurring in the industry (Butler and Marion, 1983). Evidence collected to date suggests that the seed industry is currently in a state of transition. Private enterprise is

taking over some of the functions which have traditionally been regarded as belonging to public research institutions. While structural and behavioral changes are occurring, it may be too early to judge yet whether these changes will result in the emergence of highly concentrated subsectors.

Several factors will determine whether or not changes in the seed industry, or more specifically, the genetic supply industry, will result in increased concentration of sales among the largest sellers. Much depends, for example, on whether or not the envisioned breakthroughs in the new biotechnologies actually occur and whether or not they will be commercially feasible. Much also depends on how much and what forms of protection and barriers to entry the industry can achieve to protect its commercial investments in the new biotechnologies.

In many ways, the envisioned breakthroughs in the new biotechnologies strongly resemble the discovery and commercial development of hybrid corn in the 1930's. Today, the corn seed subsector is the most highly concentrated of all the seed subsectors. Typically, the corn seed subsector prevents farmers from growing their own seed, exhibits relatively high barriers to entry, and is dominated by a few large companies. It is possible that commercially successful breakthroughs in biotechnological research will result in other subsectors of the seed industry becoming equally as concentrated as the corn seed subsector. Whether or not such breakthrough will significantly affect market forces is unknown.

Genetic Diversity and Other Nonprofitable Improvements

Genetic diversity is one of the basic underlying precepts of plant and animal breeding. It is the range of genetic differences between individuals or groups of organisms. Genetic diversity reflects the ability of an organism to utilize the full range of its genetic resources to survive in various environments. For example, an organism with a narrow spectrum of genetic resources will survive only in a narrow range of environments and may be susceptible to a single virus or strain of bacteria. Thus genetic diversity is essential to the maintenance of our food system (Dept. of State, 1982).

Uncertainty arises over the question of the potential effect which bioengineering may have on this diversity. The new technology of embryo transplants for dairy cows seems to have the potential of considerably narrowing the variety of females following the narrowing of bulls achieved by artificial insemination.

While most breeders and scientists recognize the value of genetic diversity and its necessity in maintaining plant and animal systems against the onslaught of unexpected viral or bacterial attack, most private breeders cannot afford to breed for genetic diversity or other hard to perceive quality improvements because there is no com-

mercial market for them. Since the goals of breeding are determined primarily by the commercial feasibility of marketing, there is a tendency to breed organisms with characteristics which are "saleable." This tendency tends to narrow the spectrum of genes available, thus inadvertently leading to the creating of genetically vulnerable plants and animals.

There are other quality changes which may be incomprehensible and thus give commercial breeders no opportunity for profit. For example, a public breeder may have the incentive to make small improvements in the protein content of cereals, improvements which would be a waste of time for a private breeder.

Conclusions

Genetic engineering and biotechnology hold the promise of significantly altering the speed and content of technological change. They could produce dramatic changes in farm production and agri-business and in the functions of research and education. Technology will affect the performance of present institutions. And institutions affect the manner in which the potential benefits and costs of technology are realized and distributed. This paper addresses some of the policy issues that will have to be dealt with in the future.

One set of issues involves the mix of private and public research. Cumulative public decisions now seem to place greater reliance on private research and private finance even when the research is done in public universities and mixed with public funds. How will the institutional incentives affect the supply of basic research, the training of future scientists, the choice of subject matter, and the communication of knowledge?

Property rights (patents) in inventions are important if the role of private research is to expand. Can a balance be found between rights of firms to recover research investments and the interests of the consumer in avoiding unreasonable monopoly profits? How do other market strategies leading to oligopoly interact with rights in inventions? How do requirements for patents affect the research agenda? What are the incentives to achieve genetic diversity and other hard to perceive improvements in quality? Will farmers be eliminated as producers of their own seeds and will this create large profits in the seed industry?

Agricultural policy makers have tried to achieve a delicate balance between the need for continued improvements in agricultural productivity and the problems of adjusting to overproduction. This task will not be made any easier if genetic engineering significantly affects technology. Changes in plant tolerance for environmental conditions and disease could greatly alter regional production patterns. Growth hormones and disease control could alter the supplies of milk and other animal products. Large shifts in demand for certain agricultural inputs and the demand for land could

occur. All of these things could affect the incomes and asset values of farmers and agribusiness people to a greater magnitude than any past technical change. In short, important policy decisions must be made. These decisions will affect the pace and the content of agricultural productivity and the distribution of its costs and benefits.

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VII. THE CHANGING POLITICS OF THE FARM AND FOOD SYSTEM

Agriculture Policy:

A Citizen's Guide
to the American
Food and Fiber System

The Changing Politics of the Farm and Food System

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TWO CENTURIES AGO the federal government owned almost all of the vast land area that now provides the nation's food supply. Through the Homestead Act of 1862, the government distributed property rights to much of that land in small parcels. Thus family farm agriculture was established through public policy designed to place the land in the hands of those who tilled the soil.

At approximately the same time, the United States Department of Agriculture was established, primarily to provide technical assistance to farmers to enable them to improve the quality and increase the quantity of the food they produced. Agricultural colleges provided Experiment Stations and Extension Services to conduct research and disseminate information to the people.

Prior to the Great Depression, government involvement in the farm and food system focused on scientific input and on protecting and marketing our food supply. Depression hit the farm economy in the '20's, before it affected the rest of the economy. Collapse of farm prices, bankruptcies, and land foreclosures resulted in a distinct change in government involvement.

Government intervened on behalf of farmers in the marketplace, supporting prices at a parity level. Parity was defined as the relationship between prices received by farmers for products such as grain and livestock and the prices paid by farmers for fertilizer, fuel, etc. The goal was to establish the same relationship as that which had existed in the prosperous years of 1910-14. Since the Agricultural Adjustment Act of 1933, the U.S. government has been directly involved in supporting farm prices and attempting to control the amount of agricultural production.

In the '20's and early '30's surplus production caused low farm prices. The answer to this problem was to have the government support prices, which merely provided farmers with an incentive to increase production. Thus government required farmers to leave some land idle in order to receive price supports. Over the years, changes in farm programs have occurred, but the original basic tenets remain in effect. In addition to supporting prices,

the government has assisted farmers in forming cooperatives to market their products, purchase supplies, and to secure credit in the commercial world as groups rather than as individuals.

A new dimension was added to farm and food policy in the '60's, and this dimension became a vital part of the system in the '70's. We began to export more and more food products overseas. U.S. agriculture has more than enough capacity to provide all the people in the U.S. with adequate diets. Roughly, one out of every three kernels of grain produced in the U.S. is exported. We export foodstuffs to Europe and Japan, and we distribute food to the needy in the food deficient developing nations. In the '70's, we began to trade vigorously with communist countries like Russia and China. Farm and food policy is now a part of foreign policy and of our relations with friends and foes overseas.

From Farm Policy to Food Policy

Farmers once formed a majority of the population. But their numbers declined because as modern technology and farming methods became available, one farmer could produce food for more and more people. With the declining numbers of farmers it could be expected that they would lose political power and receive unfavorable treatment from government. Not necessarily so.

When the basic farm programs were established, the Farm Bloc in Congress was made up primarily of Southern Democrats and Midwestern Republicans. This group was well organized and its members put farm interests before partisan politics. They practiced majority politics and controlled farm policy. Joining the Farm Bloc in the agricultural establishment were the USDA and the agricultural colleges, and behind them were the old-line farm organizations like the Grange, the Farm Bureau, and the Farmer's Union. The South was interested in peanuts, rice, sugar, cotton, and tobacco. The Midwest was interested in wheat, corn, and other

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feed grains. Each region agreed to support the other's programs. It worked. It was a successful political coalition.

The coalition dealt with farm prices, farm income, and support for the family farm. Issues concerning food quality also surfaced. Inspection services were developed as a result of consumer protests, and with the support of the Farm Bloc, grades and standards were finally developed.

Traditionally, farmers had more political influence than their numbers indicated because state legislatures and the U.S. House of Representatives were not apportioned according to one person, one vote. A U.S. Supreme Court ruling in the '50's changed that. But other changes were in the air, and as fewer farmers were needed, migration to the city occurred. The Farm Bloc in Congress began to break apart. Farmers became a political minority. Other issues developed, and we began to talk of food policy rather than farm policy, more specifically, of the cost and quality of our food supply. Scientific input had ensured us of an adequate amount of food.

The old-line farm organizations were challenged by the rise of commodity groups like the National Association of Wheat Growers, the National Cattlemen's Association, and the National Milk Producers' Federation, and by new general farm organizations like the National Farmers' Organization and the American Agricultural Movement. But through coalitions and effective lobbying within the system, farmers maintained a degree of political power.

What are the issues now? Of course, farm prices, farm income, and saving the family farm remain on the list. But many food issues have come to the forefront, issues such as the price of food, the cost of price and income-support programs, dietary goals, world hunger, food stamp and nutrition programs, food safety, use of chemical preservatives in food preparation, pesticides, protection of the environment, preservation of prime farmland, control of wildlife that destroy farm animals, and the rights of farm animals. These issues were not put on the agenda by the old agricultural establishment that once controlled farm policy. These agricultural groups now share influence with a multitude of non-farm special interest groups which exert influence over food policy.

Who Determines Food Policy?

The producer lobby must now compromise with agribusiness organizations, food distributors, consumer groups, groups concerned with hunger and nutrition, environmentalists, labor, and the clergy. A multitude of special interest groups are highly motivated and well-financed, and they have a stake in securing an abundant supply of high quality food at the cheapest price possible. Traditionally, farm policy was determined by com-

promise within the Farm Bloc. With the influence of farmers behind a compromised set of policies, it wasn't much more than a formality to get them officially established. This is no longer true. Coalitions must be formed. Trade-offs must occur. Producers must compromise with consumers and others and establish common ground. Nonproducer interest groups now influence food policy and help establish it.

In recent history, a "farm bill" has been passed every four years. The transition from farm policy to food policy is readily apparent when one discovers exactly who and what are involved in a "farm bill." The change in the title from the Agricultural Adjustment Act of 1933 to the Agricultural and Food Act of 1981 indicates the change in politics.

Coalitions Between Farmers and Nonfarmers

Population shifts have occurred. More people now live in urban areas and the makeup of the Congress reflects this fact. If policies acceptable to farmers are to be established, these policies must also be in the best interest of consumers and other influential food lobby groups. In addition, farm interest groups must be willing to back programs sought by nonfarm groups. This is necessary in order to form coalitions with these groups.

Farmers are interested in commodity programs which support farm prices and income. They are also interested in publicly supported agricultural research. But farmers and their organizations simply don't have enough votes to enact the programs. They need non-farm support.

The food stamp and nutrition programs are of vital interest to urban and nonfarm rural Americans. Consumer and labor groups and welfare rights groups support these programs. Commodity programs and food stamp and nutrition programs, which also increase the demand for food, are the responsibility of the agricultural committees in the Congress which have farm and urban congresspersons on them. This makes for a classic trade-off. Farm groups support food stamp and nutrition programs in return for the urban groups' support of commodity programs. Coalitions are built among farm and nonfarm influential interest groups, and policy is established. Agricultural policy was once established by farm groups. Establishing food policy now requires the concurrence of many nonfarm groups.

Government Agencies

Traditionally, the **United States Department of Agriculture** has been the key government agency which proposed and administered farm policy. Price-support and income programs and food stamps and nutrition programs are operated by the USDA. Some argue that this cabinet level agency should no longer be in charge of food programs, that the operation of these programs should be switched to Health and Human Services, and

the Agriculture Department should be the farmers' department in Washington. Removing food programs from the USDA would greatly diminish both its influence and its budget.

As food policy included more and more issues, many other government agencies became involved with it. The **Food and Drug Administration** helps to protect the quality of our food supply. The **Environmental Protection Agency** is concerned with the chemicals used on the farm and in food processing. Many of these functions were once a part of the USDA but were removed because of the USDA's alleged failure to administer them evenhandedly. In recent times of tight budgets, the **Office of Management and Budget** has been heavily involved in food policy. As we export more and more of our food overseas, food policy becomes involved in foreign policy. The **State Department** enters the picture.

In the past, food exports have been restricted because consumer groups feared that foreigners were bidding up our food prices. Some feared for an adequate domestic food supply. For decades, food has been used as a weapon to try to force our adversaries to change their policies. President Carter embargoed wheat to Russia to retaliate against the Russians' use of force in Afghanistan. This ability to control how much grain is exported and the effect such control has on grain prices has moved the use of food as a weapon to the forefront of food policy issues.

Importing foods which compete with domestic production is an important policy issue to cattlemen and dairy producers. Likewise, importing automobiles and other manufactured goods is an important issue to industry. Food and nonagricultural trade policy involves the **Commerce Department**. Exporting food affects the price we must pay to import electronic products, textiles, and automobiles. Trading food for these commodities generally makes them cheaper.

The price of energy affects the cost of producing food in the U.S. Therefore, the Organization of Petroleum Exporting Countries has influenced food policy. Periods of fuel scarcity raised the issue of whether or not to allocate enough fuel to agricultural producers so that they could continue to produce at least the same amount of commodities.

Food policy is complex. Many issues and interest groups are involved. Some are more influential than others. What was once domestic policy of primary concern only to farmers now includes international trade and foreign policy and is of primary concern to groups with many diverse interests.

Formal Policy-Making Process

Both farm and nonfarm interest groups act to influence the formal policy-making process of Congress. Successful efforts to influence food policy decisions re-

quire an understanding of that formal political process. In general, three centers of legislative power are involved in formulating farm and food policy in the Congress. These include: (1) leadership control, (2) content control, and (3) budgetary control.

Leadership

Leadership control is vested in the party steering committees in both chambers of Congress. These steering committees are made up of the ranking leaders in each party. The steering committees formulate party rules and strategies and assign party members to the other congressional committees. The majority party's steering committee also nominates the committee chairperson and proposes rules to govern floor action and committee procedure.

The party caucuses in each house are composed of all party members. These caucuses approve major rules proposed by the steering committee. In addition, the majority party's rules are usually accepted for floor action and committee procedures. This occurs because all committee chairpersons are from the majority party, and the membership of each committee reflects the partisan relationship of the whole chamber. So a majority of each committee is from the majority party.

Content Control

Agricultural Committees

Content control over farm and food legislation is generally held by the agricultural committees in each house. The Senate Committee on Agriculture, Nutrition, and Forestry has 17 members and is one of 15 standing committees of the Senate. The House Agriculture Committee has 43 members and is one of 22 standing committees of the House of Representatives.

Members of Congress who are assigned to the agricultural committees have more control over the content, form, and organization of farm and food legislation than do noncommittee members. Not only do they approve the farm and food proposals presented for consideration on the floor of each house, but they also have greater access to technical staff and to the relevant information used to make decisions and lead floor debate. Access to the relevant information can be crucial to successful legislative debates.

Each agricultural committee has a staff that gathers and organizes the information desired by the committee members. The agricultural committee chairpersons have the greatest control over farm and food legislation because they preside over committee meetings and control the staff that provides relevant information.

Hearings and Mark-up Sessions

On major farm and food legislation, both agricultural committees hold extensive hearings to allow all business and trade organizations, interest groups, and concerned

citizens to express their views. After the hearings are complete and after proposals have been drafted by subcommittees or by the staffs of individual members, the agricultural committees hold "mark-up" sessions to condense all proposals and amendments into one proposal to be reported out of committee onto the floor. Representatives of the USDA attend the sessions to explain the administration's position on each provision as requested. Trade organization and interest group lobbyists communicate informally with committee members and their personal staffs behind the scenes to voice their positions on the language of specific provisions considered throughout the mark-up process. Only tentative decisions are made in this process. Thus all provisions are subject to reconsideration until the committee makes its final decisions.

Debates and Amendments

Floor action allows all members in each house of Congress to debate and amend the bills reported out of committee. Coalition leaders are hard at work forging compromises to gain enough votes to pass or defeat the bill or to amend it into a more acceptable form. The administration liaisons work behind the scenes. The White House may become involved through visits to congressional sessions and through veto threats to gain passage of a more acceptable bill. Meanwhile, interest groups and trade organization lobbyists informally attempt to gain support for their preferences. After completing consideration of all the amendments, the full body moves for final action. After the first chamber completes action, its proposal, called an "engrossed bill," is sent to the other chamber for consideration.

Conference Committees

Most comprehensive farm and food policy bills pass each chamber of Congress with differences that must be resolved before the bill is sent to the President. Major differences are usually ironed out in conference committees. Each chamber selects a delegation for the conference committee. The conferees usually include committee chairpersons, ranking majority and minority members of the committee, and other committee members who have been extensively involved with the bill. Individuals, interest groups, and the administration continue to communicate informally with the committee throughout this process.

In general, conferees may negotiate only areas of disagreement between the two versions of the bill. The final legislative passage of the bill is completed when both chambers accept the conference committee recommendations. The proposal then becomes an "enrolled bill" and is sent to the White House for presidential action.

Once the enrolled bill is delivered to the White House, the Office of Management and Budget circulates it to all concerned agencies and formal advisors. Their views

and statements are considered together with recommendations from informal advisors on the merits of the President's options. The President's options are to: (1) sign the bill, (2) veto the bill, (3) allow the bill to become law unsigned when Congress is in session, or (4) allow the pocket veto to take effect by not signing the bill when Congress is not in session.

The Budget Process

In recent years, budget concerns have begun to influence the nature and scope of farm and food policy decisions. All farm and food policy proposals are reviewed by the Appropriations Committees and must meet the budget requirements proposed by the full Congress. During the 1981 farm bill debate, the Senate Agriculture Committee pared down its original proposal in order to report a version of the farm bill that would not risk the cutting process of the Budget Committee. Therefore, budgetary control does influence the nature and level of funding for farm and food policy legislation.

Presidential Preparation

The budget process is composed of two basic steps—presidential preparation and congressional legislation. The presidential preparation phase begins almost one and one-half years before the fiscal year begins. Since 1921, most of the executive control over the budget has been centralized in the Office of Management and Budget (OMB). Before then, each agency submitted individual budgets directly to Congress.

In the spring of each year, the administrative agencies begin to prepare their budget requests for existing programs and changes. During the summer, the OMB reviews the requests, sets ceilings, and may ask each agency to defend its requests. Requests are put into final form during fall and winter, prior to the President's annual budget message given toward the end of January.

Congressional Committees

In the legislative phase, control over the budget is vested in three standing committees of each house. These committees include the Budget, Appropriations, and Finance Committees in the Senate and the Budget, Appropriations, and Ways and Means Committees in the House.

The Congressional Budget Act of 1974 establishes congressional budgetary procedures. These procedures call for the Congress to consider budget totals before it considers action on individual appropriations. The two Budget Committees review these total budget limits and draft requirements for major spending and finance categories. The Appropriations Committees draft and evaluate specific spending bills. The Senate Finance and House Ways and Means Committees draft and evaluate specific tax and revenue raising proposals. All must be

within the budget requirements accepted by Congress and the President.

Process Sequence

The legislative component of the budget process begins with the President's message. In the first phase, all standing committees must report estimated appropriations to the Budget Committees by March 15. In the second phase, the Budget Committees must have reported their first budget resolution to the floor for passage by May 15. This first resolution tentatively sets the total budget and limits for each budget category. In the third phase, the standing committees rework their appropriations to bring each function in line with the budget limits. By September 15, a second budget resolution which may revise the first is passed. Strictly interpreting the Budget Act, Congress may not appropriate more money by function or in total than it adopts in its second budget resolution. If these budget requirements are not met, the Budget Committees may begin a cutting process to bring all appropriation proposals into line.

The Executive Branch and interest groups are continually communicating with the Congressional Budget decision makers. Presidential veto threats occurred frequently during the 1977 and 1981 farm and food policy debates and eventually altered the content of the legislation.

Continuing Resolutions

If final appropriations are not passed by September 30 (October 1 is the beginning of the fiscal year), a "continuing resolution" is passed and signed by the President. Continuing resolutions are temporary appropriations for a specific time period. They are usually based on appropriations for the previous year and include minor changes. In the past two years, final appropriations were not completed until after the beginning of the fiscal year. Therefore, all federal agencies operated under continuing resolution appropriations until the final decisions were made.

Implementing and Evaluating Policy

The responsibility for implementing farm and food policy rests primarily with the administration. The Secretary of Agriculture is responsible for developing most of the administrative rules for implementing farm and food legislation. These rules must be developed within the flexibility written into the legislation by Congress and under guidance from the White House. In addition, farm and nonfarm interest groups continually attempt to influence the Secretary's administrative decisions.

The responsibility for evaluating the impacts of farm and food policies rests within all branches of government. The administration may revise administrative rules whenever evaluations dictate. All revisions are subject to the Administrative Procedures Act, but

beyond these limits, farm and food program rules may vary from year to year depending on circumstance and political pressure. The recent Payment-in-Kind Program was essentially conceived, designed, and implemented totally by administrative order, underscoring the flexibility given the Secretary in the 1981 Act.

The Congress has "oversight" responsibility, and from time to time it conducts hearings to make sure the administrative agencies are implementing the intent of the law. If they are not doing so, the Congress may revise the law to alter the implementation. In addition, the General Accounting Office, which is not an administrative agency but is responsible to Congress, audits, studies, and analyzes the implementation of all laws and expenditures upon Congressional request.

In addition, farm and food lobby groups have learned that many agencies outside of the USDA influence the implementation of farm and food policies. For example, both the Environmental Protection Agency and the Food and Drug Administration write administrative rules and regulations that directly influence the farm and food system.

The judicial system has the authority to make final evaluations. The courts may judge whether implementation of a policy is arbitrary and lacks uniformity, whether the administrative rules are in accordance with the law, and whether the law is constitutional. So from time to time the courts have been influential in setting farm and food policy.

Future Political Environment

The politics of the farm and food system have been in transition during recent years. This evolutionary process will continue well into the next century. As the lines of compromise are redrawn over time, traditional institutions are likely to be continually scrutinized and redefined.

Clearly the old agricultural establishment no longer has exclusive control of farm and food policy. Many argue that it will never regain control. Numbers alone would support that contention. Less than 2 percent of the U.S. population is engaged in producing food and fiber. This translates into only a few votes in the ballot box. Agriculture's political power is fragmented. Farm organizations and commodity groups openly disagree and engage in protecting their own turfs. Division within the establishment weakens the whole.

When the old agricultural establishment was in control, its members practiced majority politics. Producer organizations ignored or bad-mouthed agribusiness and detested the middleperson. They made little, if any, effort to influence the consumer. To many producers, the consumer was the enemy rather than the customer. Few attempts were made to build coalitions or to court non-farm groups through educational and public relations activities.

This approach may have worked in the "good old days" but with agricultural producers in the minority, it will not work any more. Many farm organizations are aligned with one political party. Consequently, one party tends to take them for granted and the other one tends to ignore them. A lesson remains to be learned from the bi-partisan nature of the old Farm Bloc. But change has been in the wind. There are now fewer farmers and many of them are becoming more interested in the politics of the farm and food system. Their economic environment is being altered politically. Politics adds a degree of instability to agriculture which is second only to the weather. Witness only a modest acreage reduction program in 1982, then in 1983 the most massive acreage reduction program in the history of U.S. agricultural policy. This was carried out by the same administration under the same farm legislation. A philosophically free market administration operating under the 1981 Agriculture and Food Act abruptly changed its agricultural policy.

Economic Policy

Agriculture is not immune from general economic policy. A long sustained economic recovery with relatively low inflation and real interest rates would improve the farm economy, if for no other reason than that such a recovery would moderate the value of the dollar in terms of foreign currencies. This would expand food exports and strengthen farm prices, but it would also increase the cost of imports. Global politics affects the economic environment in which agriculture operates. Agricultural policy is important to farmers but so are national and international economic policy.

Budgetary concerns will play a major role in limiting the size and scope of 1985 farm and food legislation. Concern over record federal deficits which are approaching \$200 billion annually will compound the problem.

Congress is usually inclined to accept presidential preferences on the budget during the President's honeymoon, particularly after a wide election margin. In 1981, the Congressional Budget Committees accepted the President's proposals without subcommittee review. As a result, provincial budget interests were bypassed. In the President's third year, the congressional budget did not reflect the President's priorities. After the 1984 election, either the President or the Congress may be vindicated. As a result, the budget priority given to the 1985 food and agriculture proposals will depend in part on the economic environment during the campaign and on the election results.

Many argue that today's agricultural policy does not fit the economic realities of the '80's, that it was designed for a domestic market and we are now dependent on international trade. Agriculture must learn to operate competitively in the international marketplace

or scale down its level of grain production by roughly one-third. The foreign dimension and the use of food as a foreign policy tool add to the political instability which agriculture faces.

The days of efficient family farmers operating just inside the farm gate are over. It will take more than efficiency to survive the political and economic transition occurring in the system. Farmers and their organizations are beginning to discover this. The events of the past decade have awakened some of those in the trenches to the events that may lie ahead.

Planning Farm Policy

Traditionally new farm legislation occurred every four years, giving producers a four-year planning horizon. The 1981 Act is discretionary. It gives the Secretary of Agriculture the authority to move from modest intervention to record land retirement. In addition, the annual budget-making process can produce changes in farm programs. The planning horizon has gone from four years to less than one year, but even four years is not consistent with the investment process in modern mechanized agriculture. The 1983 wheat program was announced about four months after the winter wheat crop was planted, giving those wheat producers a minus four months planning horizon.

The bottom line in developing the 1981 Farm Bill was the cost to the Federal Treasury. A tight budget dampened the amount of funds available for farm programs. Many argue that the days of dipping into the Federal Treasury for billions of transfer payments to agriculture are drawing to a close. Yet, 1983 program costs approached \$30 billion in a so-called tight budget year, a tenfold increase in three years. Is this the high-water mark? That depends in part on agriculture's political clout. Much has been written about the decline in agriculture's political power, but agriculture possesses enough political power to curb the market on the downside, to place a floor under prices.

Developing Long-Term Policy

Such events have led to early discussion on the 1985 Farm Bill. Agricultural forums and attempts to decrease the fragmentation within agriculture are underway. Many groups are calling for long-term solutions rather than piecemeal, short-term, emergency stopgap solutions.

In 1983, agriculture marked the golden anniversary of the Agricultural Adjustment Act of 1933. Is the politics of the system such that the AAA will be amended on an emergency basis once again in 1985, or will 1985 be a watershed year?

Should we insulate agricultural policy from the day-to-day whims of the political system? How could we achieve a long-term comprehensive set of agricultural policies consistent with the length of the planning

horizon needed to make investment decisions in today's agriculture? More fundamental, is the political system itself capable of developing long-term policy?

In his farewell address, President Carter lamented the fact that we had become a government of special interests and asked, "Who is looking after the good of the whole?" Farm and food policy has been short-term and inconsistent, frequently switching back and forth between concerns about increasing production to maintain an adequate food supply and decreasing production to eliminate surpluses. The record has been one of reacting to crisis and enacting legislation on an emergency basis. Special interest groups have seen to it that agricultural prices are moderated upward at the insistence of producers and downward at the insistence of consumers. Such a record demonstrates the government's lack of ability to develop a long-term comprehensive set of food and agricultural policies.

Some suggest that a new institution is needed to develop a long-term comprehensive set of policies for the farm and food system. This would call for a new approach to developing agricultural policy. Models that come to mind are the Farm Credit Administration and the Federal Reserve System, quasi-independent bodies that are partially immune from day-to-day politics. Individuals of stature from across the farm and food system would be selected by the President for terms longer than presidential terms, and not concurrent with them, and confirmed by the Senate. Congress would pass enabling legislation which would delegate authority to develop agricultural policy to the new institution.

This would be a distinct departure from past policy and would threaten the turf of the congressional agricultural committees, the Secretary of Agriculture, the traditional farm organizations, and nonfarm groups. Thus it would be politically feasible only if a groundswell of grassroots support for it emerged throughout the farm and food system, from input supplier to producer to consumer. Such a distinctly different approach may, however, be required if long-term agricultural policy is to be developed and if 1985 is to be a watershed year.

Control of Food Supply

If current trends continue, control of our food supply will be concentrated in fewer and fewer hands. Perhaps as few as 200,000 commercial farms will be producing

95 percent of our food supply in the year 2000. A highly concentrated integrated farm and food system will take on a new political complexion.

Clearly the need for producers to become more politically involved is evident and 200,000 is a small enough number that farmers may get their political act together. Suppose agribusiness joins with producers to develop a political coalition? The smaller the number of producers and the more integrated the system, the easier it is to form such a coalition. Could a coalition across commodities and including agribusiness become the new agricultural establishment and gain back more of the control of farm and food politics?

Conflicting Goals

A basic conflict exists between the consumer's goal of an abundant supply of high quality food at the cheapest price possible and the producer's goal of maximum income. How could this conflict be resolved? That depends on the politics of the system, at least to a degree. Currently, farmers argue that the U.S. is following a cheap food policy, and they surmise that is true because food policy is being made in an urban society where consumers have the most clout. If producers and agribusinesspeople begin to practice effective minority special interest politics, the scale could be tipped towards returns in the system rather than low food prices. It is not clear that the agricultural establishment has permanently lost control of farm and food policy. Political power is more than numbers. It incorporates organization, economic clout, and the ability to threaten. Control over our food supply certainly constitutes an ability to threaten. Crosscurrents are blowing through the system. The politics of agriculture are changing. The outcome is not at all clear.

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Appendix

AGRIBUSINESS — Firms engaged in production and distribution of agricultural inputs or in the marketing, processing, or distribution of agricultural commodities.

AGRICULTURAL POLICY — A broad term used to encompass those government programs that most directly affect the prices and incomes received by farmers.

BALANCE OF TRADE — The difference between the amount of exports and imports. The balance is positive if exports exceed imports or negative when imports exceed exports.

CARRYOVER — The supply or volume of a farm commodity not yet used at the end of a marketing year. It continues to be stored or is used during the following marketing year.

CASHING OUT — A term used to describe proposed food assistance in the form of cash rather than commodities or food stamps.

COMMODITY CREDIT CORPORATION (CCC) — A government owned and operated corporation authorized to borrow funds from the U. S. Treasury to operate the U. S. Department of Agriculture's price and income support programs, to manage government owned stocks of agricultural commodities and administer their disposal through domestic and export programs. Most activities are carried out by ASCS personnel, although certain programs are administered and implemented through the Agricultural Marketing Service, the Foreign Agricultural Service, and the Food and Nutrition Service.

COST-OF-PRODUCTION — The average amount, in dollars-per-unit, to grow or raise a farm product, including all purchased inputs and sometimes including allowances for management and use of land owned by the farm operator. The cost may be expressed in units of a bushel, pound, ton or per-acre, depending on the product involved.

CROSS COMPLIANCE — The requirement that if a farmer wishes to participate in a price support program and qualify for price support and loans in that program, he must also meet the program provisions for other major program crops which he grows. (Also see OFF-SETTING COMPLIANCE)

DEFICIENCY PAYMENTS — Federal government funds paid to farmers when farm prices are below the target price. The payment rate is determined by subtracting the average market price for the first five months of the

EXCHANGE RATE — The rate at which the currencies of different countries can be exchanged.

EXPORTS — The goods and products which are sold to buyers in foreign countries.

FAMILY FARM — A farm in which a single family provides most of the labor, management decisions and operating capital. The land may be owned, partly owned or rented. Some economists estimate that most family farms would have annual sales between \$40,000 and \$200,000.

FARM — Starting in 1978, the Bureau of the Census defined a farm as any place that has or would have had \$1,000 in gross sales of farm products.

FISCAL POLICY — Policy made by Congress and the executive branch that deals with the amount of money expended and the amount of revenue raised by the federal government.

FOOD STAMPS — Stamps issued to low income individuals and families to buy food in retail stores, authorized under the Food Stamp Act of 1964 and later amendments. In 1977, the purchase requirement was eliminated and all food stamps are now given to eligible persons. The program is now the largest domestic food assistance program, totalling about \$10.4 billion in fiscal year 1982.

IMPORTS — The goods and products that a country buys from foreign countries.

INPUT — Items used in the production of an agricultural product such as seed, fertilizer, chemicals, feed, machinery, fuel, labor and land.

LOAN RATE — The price per unit (bushel, bale, pound) at which the government will provide loans to farmers to enable them to hold their crops for later sale. (Also see NONRECOURSE LOANS).

LOBBYISTS — Individuals and organizations that attempt to influence decisions by members of Congress and other government officials.

MACROECONOMIC POLICIES — Policies that affect the total economy or sectors, such as agriculture, rather than individual farms or business firms. Monetary and fiscal policies would be examples.

MARKETING BOARD — A central government authority in certain foreign countries that directs all purchases and sales of a given commodity in both the domestic and foreign markets. The most frequently performed function of a marketing board is the management of exports.

MONETARY POLICY — Policies carried out by the Federal Reserve Board to influence the supply of money and the rate of interest.

OFF-SETTING COMPLIANCE — The requirement that if a farmer wishes to participate in a program for one farm he must also meet the program provisions for other farms which he owns or operates. (See CROSS-COMPLIANCE).

PARITY — A relationship which defines a level of purchasing power for farmers equal to an earlier base period. The base period as defined by law and used in calculating parity prices is 1910-14. Some farmers, rather than using the technical definition above, think of parity as simply "a fair price plus a reasonable profit."

PAYMENT-IN-KIND (PIK) — A program which provides payment to farmers in the form of commodities for reducing acreage of certain crops and placing that acreage in conserving uses.

PRICE SUPPORTS — Government programs which aim to give farmers higher prices for their products than they would get without government help. Most price support programs are carried out by providing loans to farmers so they can store their crops during periods of low prices, making direct purchases of certain commodities, or making direct payments under certain conditions.

PRODUCTION CONTROL PROGRAMS — Any government program intended to limit production. At various times these programs have been called acreage reduction, reduced acreage, set-aside, diverted acreage, acreage allotments, marketing quotas, PIK, and soil bank.

PROTECTIONISM — The setting of customs duties or quotas high enough to discourage foreign imports or to raise their prices sufficiently to enable relatively inefficient domestic producers to compete successfully with foreign producers. These barriers "protect" domestic producers from lower priced foreign goods.

PUBLIC LAW 480 (P.L. 480) — The name commonly used to refer to the The Agricultural and Trade Assistance Act of 1954. It has been amended and extended several times since its original passage. It authorized long term and low interest loans as well as commodity donations to developing countries.

REAL RATE OF INTEREST — The rate of interest earned after deducting the average rate of inflation.

SCHOOL LUNCH PROGRAM — The oldest and largest of the child feeding programs, authorized by the National School Lunch Act of 1946. The federal cost in 1982 was \$2.2 billion.

SPECIAL MILK PROGRAM — First established in 1954, the program is now part of the USDA child feeding program. Federal cost in 1982 was \$19 million.

STRUCTURE OF AGRICULTURE — The make-up of the agricultural sector — usually described in terms of numbers and sizes of farms, types of farm business organizations, and other features that determine the control of agricultural assets and management decisions.

SUBSIDY — A government payment. Subsidies are paid to many people and firms under many different programs.

TARGET PRICE — A price for certain crops established by law. If the average market price does not equal the target price, qualifying farmers receive a deficiency payment to make up the difference. Generally, deficiency (or target price) payments are made if average market prices do not equal the target price for the first five months of the marketing year. The target price for 1984 corn is \$3.03 per bushel. (See DEFICIENCY PAYMENTS.)

TECHNOLOGY — In agriculture, the scientific methods, techniques and systems used in modern farm production and marketing of farm products.

THRIFTY FOOD PLAN — A food budget designed by USDA home economists to give adequate nutrition at the minimum cost.

TRADE DEFICIT — The amount by which a country's imports exceeds its exports.

WIC (Women, Infants, and Children) — A special supplemental program first set up in 1968 to provide eligible persons with nutritious foods. In 1972 Congress created the special supplemental food program as Section 17 of the Child Nutrition Act of 1966. Local agencies now provide participants either with vouchers redeemable for specified foods at participating retail food stores or with a food package prepared according to federal guidelines. Eligibility extends to infants, children to age six, women during pregnancy and up to six weeks after giving birth, and breast feeding women up to one year after giving birth. Federal cost in 1982 was \$987 million.

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